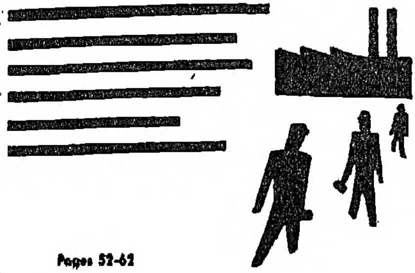
Bar Graphs



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Finding per cent

20 % of $5 = ?

$1 = ? % of $5

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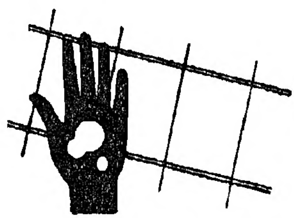
Finding interest



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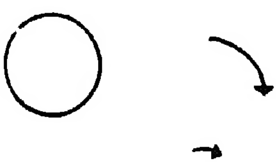

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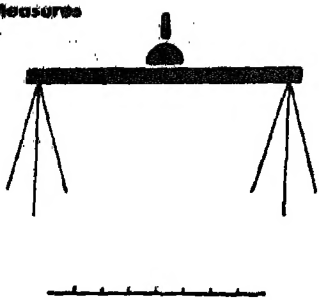

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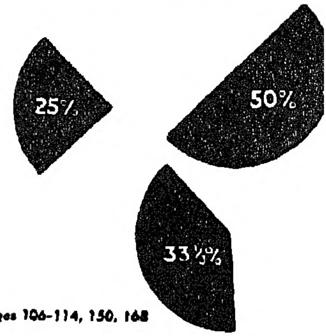

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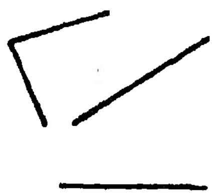

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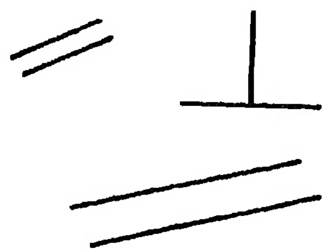
Position of lines



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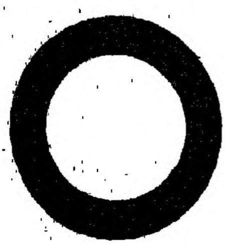

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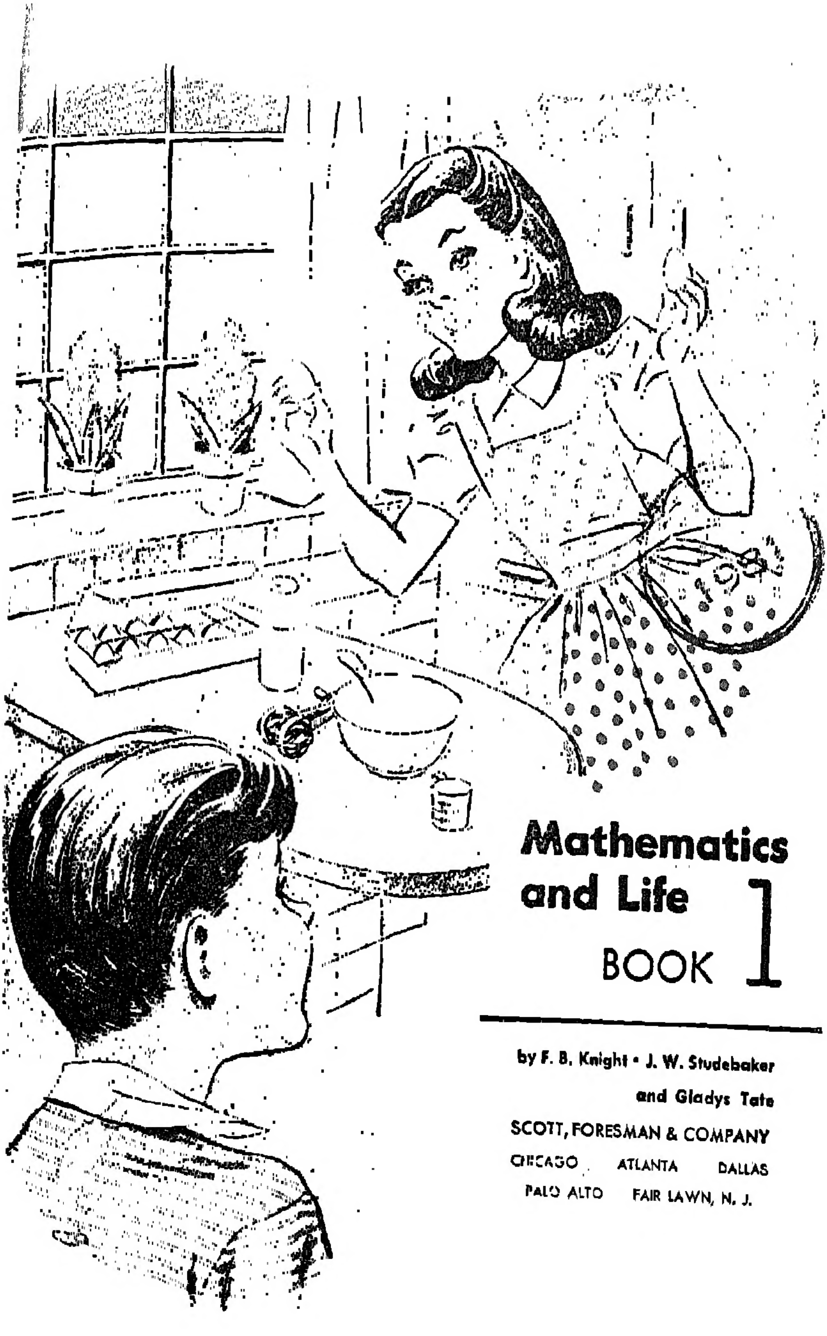

Mathematics and Life

BOOK 1

by F. B. Knight • J. W. Studebaker
and Gladys Tate

SCOTT, FORESMAN & COMPANY
CHICAGO ATLANTA DALLAS
PALO ALTO FAIR LAWN, N. J.

For detailed information concerning the mathematical contents of this book see pages 473-479.

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Contents

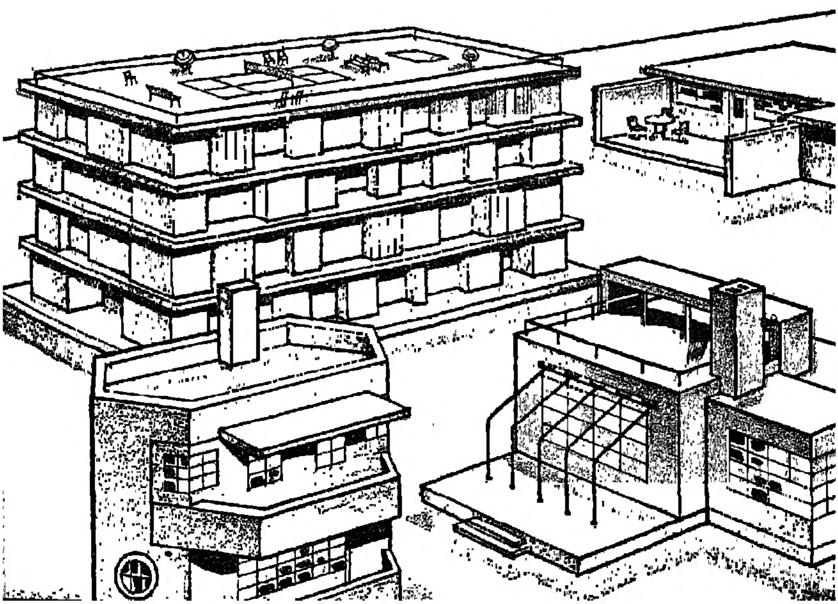
CHAPTER 1

The Home and Mathematics

The Home of the Future

The boys and girls in the picture are looking at some models of very modern houses. These houses are different in many ways from the ones most of us live in now, but some architects say that in only a short time many of us will live in houses like them. These houses are designed for healthful and convenient living.

Artists, designers, scientists, engineers, and architects have worked for years planning houses that are better suited to our life today than the houses we now live in. The work of these persons, as well as the work of the men who build and repair our houses, would be impossible without mathematics. All these persons must make good use of lines, do accurate figuring, and make accurate measurements.



A family must have more than a modern house to make a successful home. A home can be successful only when the family works, plans, plays, and manages its affairs together.

A successful home is really a business. Someone must earn money to keep it going. Someone must manage the money that has been earned so that there will be enough to pay expenses and some to save. No home can be successful unless the family's expenses are planned to fit its income.

In every efficient home many things must be done according to a plan. Proper amounts of food, clothing, and household supplies must be bought, repairs must be made, and bills must be paid on time. All of these things take much planning and figuring.

The home will be more interesting to all the family if improvements and changes are made from time to time. Changes in the garden and yard are often necessary, and they frequently add to the beauty of the home. Conveniences can be added to the house, and improvements can be made to suit new ideas. Careful planning and figuring by the family when such work is to be done will save time, labor, and money.

In every well-managed home someone has to know how to plan, how to figure, and how to measure. Someone has to understand budgets, bank accounts, bills, and buying at stores. You can do your part in the important business of running your home if you will learn about some of these things.

This book will show you the most important ways in which mathematics is used in your everyday life and in your home.

1. If only approximate measurements were used when a house was built, how would its appearance differ from that of a house built according to very exact measurements?

2. Why is it important to use standard sizes for equipment, appliances, plumbing, doors, and windows in the modern home?

3. Why would such standard sizes be impossible without mathematics?

4. Why would it have been impossible for the pioneer to build a house like one of those in the picture on pages 4 and 5?

5. Name some of the ways in which families earn the incomes on which they live.

6. What kind of income did the pioneer family have?

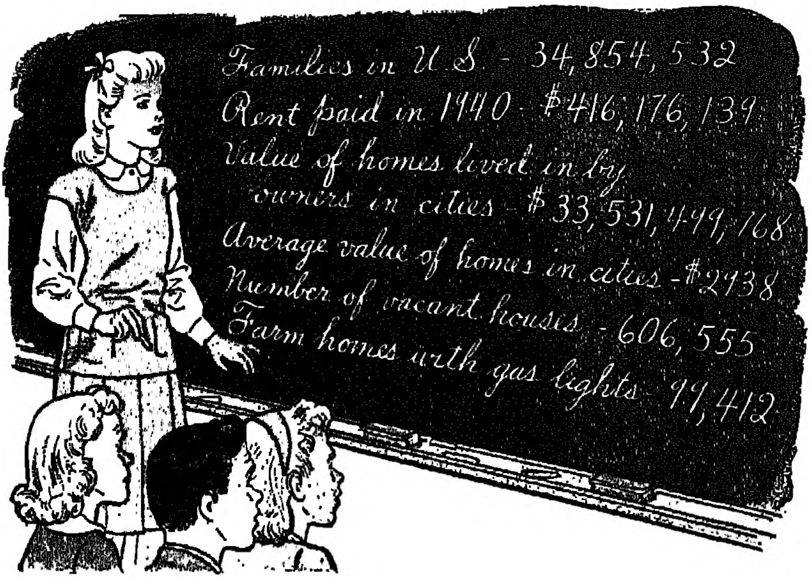
7. Would it be correct to say that the modern family manages money and that the pioneer family managed produce? Why?

8. Does the modern family have a greater need for mathematics than the pioneer family did? Why?

9. What different kinds of businesses serve your home? How does mathematics have an important part in these dealings?

10. How would you go about planning the yard and surroundings of a modern home? Give some examples of the kind of figuring you would have to do.

11. What are some of the improvements and changes in the home's surroundings that cannot be made without mathematics?



Reading and Writing Large Numbers

Ann has just written on the blackboard some of the information that she and her friends found about the families and their homes in the United States. The boys and girls had trouble reading some of the numbers. So Tom made a chart to help read large numbers. His chart is at the bottom of the next page.

1. Look at the first number in Tom's chart. How many figures does it have? It is divided by commas into groups of __ figures each. You begin at the right when you divide a number into groups. Why are there only two figures in the group at the left?

To read the number, read each group of figures as though it were a number by itself. Then look at the top of the column to see what to say for each group.

Read the first number this way, "33 *billion,* 531 *million,* 499 *thousand,* 768."

2. Look at the next number in Tom's chart. The chart tells you to read it, "416 __, 176 __, 139."

3. The third number is 2 __, 5 __, 25 __.

4. Read the other numbers in Tom's chart.

5. Copy the following numbers on your paper. Mark them off with commas ready for reading.

Row A	14679	472000	300670056
Row B	20000	9040798	6008329151
Row C	56009	34789402	369790000000
Row D	326421	8563421	62380002

6. Each place in a number has a name. Tom put the names of the places at the bottom of his chart because some of them are not used in reading the numbers. In the first number in the chart the 4 is in the hundred thousands' place. The 1 is in the __ place.

7. Whenever there is no figure for a place in a number, a zero is used. What would happen if you wrote the third number in Tom's chart without using zeros?

Say, "BILLION."			*Say, "MILLION."*			*Say, "THOUSAND."*					
	3	3,	5	3	1,	4	9	9,	7	6	8
			4	1	6,	1	7	6,	1	3	9
		2,	0	0	5,	0	2	5,	0	0	0
							9	9,	4	1	2
				3	4,	8	5	4,	5	3	2
						6	0	6,	5	5	5
1	0	0,	7	1	0,	0	0	0,	5	0	0
								2,	9	3	8
					2,	0	4	0,	0	5	0
				5	2,	0	0	0,	0	0	0
HUNDRED BILLIONS	TEN BILLIONS	BILLIONS	HUNDRED MILLIONS	TEN MILLIONS	MILLIONS	HUNDRED THOUSANDS	TEN THOUSANDS	THOUSANDS	HUNDREDS	TENS	ONES

8. The number at the right tells how many houses there are in Hilton. The 1 in the ones' place means 1 house. The 1 in the tens' place means 10 houses. The 1 in the hundreds' place means ___ houses. How many houses does the 1 in the thousands' place mean?

1 1 1 1

1 in the tens' place means ___ times as many as 1 in the ones' place.

1 in the hundred thousands' place means ___ times as many as 1 in the ten thousands' place.

Write each number below in figures. Put commas where they belong in the numbers you write.

9. five million seven hundred thousand

10. five billion seven hundred thousand

11. forty thousand nine hundred fifteen

12. one hundred billion

13. ten billion six million forty thousand two

14. seven hundred ten thousand ninety-nine

15. two hundred four million eight hundred seventy-three thousand eleven

Read the sentences below. Be careful to read the numbers correctly.

16. 28,363 families in the state of New Mexico in 1940 consisted of six or more persons per family.

17. 15,195,763 families in the United States owned their own homes in 1940.

18. In the same year 19,658,769 families lived in rented houses or apartments.

19. 859,859 city families reported that they paid rents of from \$50 to \$74 per month for their homes in 1940.

Some Important Words in Mathematics

In mathematics you must know the exact meanings of the important words. This page and the next one will review some of these important words.

1. In Example A, 32 is multiplied by 4. 4 is the *multiplier*. What is the multiplier in Example B?

2. In Example C, 18 is divided by 2. 2 is the *divisor*. What is the divisor in Example D?

3. When a number cannot be divided exactly by another number, the amount left over is called the *remainder*. What is the remainder when 14 is divided by 3?

A: $4 \times 32 = 128$

B:
$$\begin{array}{r} 18 \\ \times 3 \\ \hline 54 \end{array}$$

C:
$$2\overline{)18}\ \ 9$$

D: $27 \div 3 = 9$

4. To find the *average* of four numbers, first add the numbers. Then divide the sum by 4. To find the average of 7 numbers, first __ the numbers. Then divide the __ by __. Find the average of 6, 5, and 4.

5. The numbers 1, 96, and 489 are *whole numbers*. What two whole numbers come between 99 and 102?

6. One fourth is written in figures as shown at the right. $\frac{1}{4}$ is a *common fraction*. Write these common fractions in figures: one sixth, three tenths, nine eighths, two thirds, five sixteenths.

$$\frac{1}{4}$$

7. In the common fraction $\frac{5}{6}$, the 5 is the *numerator*. The 6 is the *denominator*. The number above the line in a fraction is the numerator. The number below the line is the denominator. Give the numerators: $\frac{3}{10}$, $\frac{12}{5}$, $\frac{1}{8}$, $\frac{5}{6}$. Give the denominators: $\frac{8}{15}$, $\frac{1}{2}$, $\frac{17}{12}$, $\frac{7}{8}$.

8. Fractions like $\frac{1}{2}$ and $\frac{3}{4}$ are less than 1. They are called *proper fractions.* The number in the numerator is smaller than the number in the denominator. Which of the following are proper fractions: $\frac{7}{8}$, $\frac{4}{3}$, $\frac{4}{5}$, $\frac{6}{6}$?

9. Fractions like $\frac{8}{8}$ and $\frac{10}{3}$ are equal to 1 or more than 1. They are called *improper fractions.* The number in the numerator is either the same as the number in the denominator or larger than it. Which of the following are improper fractions: $\frac{5}{6}$, $\frac{6}{5}$, $\frac{2}{2}$, $\frac{2}{3}$?

10. Seven and three eighths is written as shown at the right. $7\frac{3}{8}$ is a *mixed number.* A mixed number is made up of a whole number and a fraction. Which of the following are mixed numbers: $\frac{5}{6}$, $1\frac{1}{6}$, 4, $\frac{7}{6}$, $2\frac{3}{4}$?

$$7\frac{3}{8}$$

11. Look at the number below. Numbers like this, written with a point at the left, are called *decimal fractions.* This number is read "three tenths." The point is called the *decimal point.* Which of the numbers below are decimal fractions?

$$.3$$

$\frac{5}{6}$	4	.5	$3\frac{1}{2}$	.05	50	$\frac{7}{10}$

12. Which numbers below are whole numbers?

10	.32	$4\frac{1}{2}$	$\frac{4}{5}$	3	$\frac{4}{3}$	.04	$8\frac{3}{4}$	$\frac{3}{2}$	$\frac{7}{8}$

13. Which of the numbers above are common fractions? Which of the numbers are mixed numbers?

14. Which of them are proper fractions?

15. Which of them are improper fractions?

16. Which of them are decimal fractions?

To the Teacher: Page 468 contains an explanation of mathematical terms which are unnecessary in the text itself. If your course of study requires the mastery of these terms, have your pupils study page 468 at this time.

Warming-Up Exercises*

Your teacher is going to give you some Review Tests. These tests will show how well you can add, subtract, multiply, and divide. After you have taken the tests, you will be given some practice if you need it. Before you take the tests, copy and work the examples on this page. Think of them as "warming-up exercises" that will prepare you for the tests.

1. Add:

				8	
	50		989	98	
	6	82	556	634	764
87	87	549	767	82	4832
69	96	478	548	635	7563

2. Subtract:

45	895	838	3002	12470	47060
27	571	373	459	3876	39805

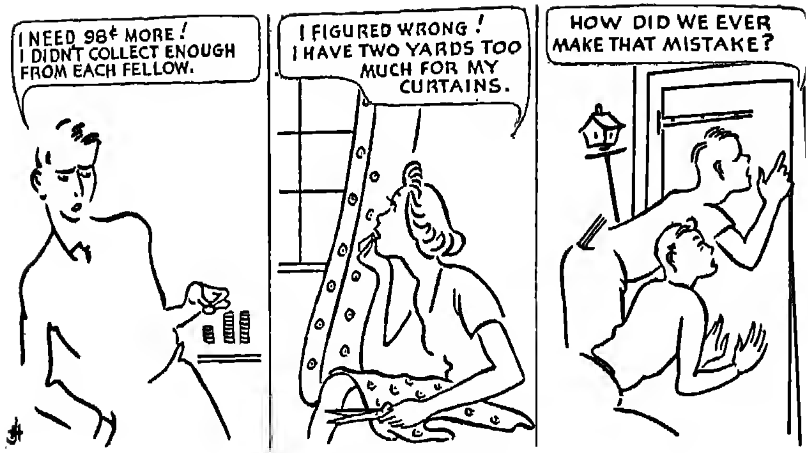
3. Multiply:

902	68	768	359	673	590
7	16	37	48	209	950

4. Divide:

$7\overline{)13902}$ $\quad 59\overline{)7980}$ $\quad 36\overline{)10563}$ $\quad 98\overline{)36305}$ $\quad 183\overline{)12720}$

*To the Teacher: After pupils have worked the examples on this page, administer Review Tests 1-4 (pp. 415-417). The standards for the Review Tests, as explained in the footnote on page 415, will show which children need remedial work. This remedial work can be individualized by administering the Self-Help Tests (pp. 422, 424, 426, and 429), which are diagnostic in character, and then giving each pupil Self-Help Practice (pp. 422-424, 424-426, 427-429, and 430-433) in amounts suited to his needs. The footnotes on pages 415 and 422 explain administrative procedures in detail.



How to Check Your Work

These pictures show three foolish mistakes that were made because figuring and measuring were not checked. It is always wise to use some way of checking your work to see if it is correct. As you learn more about mathematics, you will find new ways of checking. This page and page 15 review a few ways to check your work.

To check Example A, first find the sum by adding *up* each column. Then find the sum by adding *down* each column.

If your work is correct, you will get the same sum both times. You cannot be sure that your work is correct until you get the same sum by adding down that you got by adding up.

A

$$\begin{array}{r} 897 \\ 356 \\ \underline{798} \end{array}$$

Add and check in each of the examples below.

	73	66	88	400	
96	98	78	6	189	453
25	20	45	41	307	799
43	54	2	26	78	986

Example B shows how to check subtraction. To check the work, add the numbers to which the arrows point.

What is the sum of 781 and 1689? Is it the same as the top number of the example? If it is not the same, the example should be worked again.

B

$$\begin{array}{r} 2470 \\ \underline{781} \leftarrow \\ 1689 \leftarrow \\ 2470 \end{array}$$

Subtract in the examples below and check your work.

5754	953	1603	2009	6482	65420
960	648	879	544	5086	8139

To check multiplication, do the multiplying again. Sometimes it is a good idea to use the other number as the multiplier when you check. If your work is correct, you will get the same answer both times.

Multiply in each example below. Check your work.

8159	370	5802	374	469	2875
46	54	218	286	930	793

Example C at the right shows how to divide 2591 by 68.

To check the work, multiply 38 by 68, as in Example D. Then add the remainder, 7.

If the work is correct, this sum will be the same as the number divided. Is Example C correct?

C

$$\begin{array}{r} 38 \\ 68\overline{)2591} \\ \underline{204} \\ 551 \\ \underline{544} \\ 7 \leftarrow \end{array}$$

D

$$\begin{array}{r} 38 \\ \underline{\times 68} \\ 304 \\ \underline{228} \\ 2584 \\ \underline{+7} \leftarrow \\ 2591 \end{array}$$

Divide in each example below. Check your work.

$94\overline{)3572}$ $80\overline{)69120}$ $303\overline{)21809}$ $678\overline{)22148}$ $76\overline{)60344}$

The People and Homes of the United States

Every ten years since 1790 the government has made a count of all the persons and homes in the United States. This count is called the *census*. Most of the figures used in the following problems are from the Bureau of the Census, which has charge of the census.

Before you try to solve a problem, read it carefully. Then decide whether one, two, or more than two steps are needed to solve it. For each step think of the answers to the four questions below before you do any figuring.

1. *What am I to find out?*
2. *Should the answer for this step be larger or smaller than the numbers I shall be working with?*
3. *Should I add, subtract, multiply, or divide?*
4. *What numbers should I use?*

Now solve the problems on pages 17 and 18. Be sure that your answers are sensible.

1. In 1940 there were 131,669,275 persons in the United States. At that time families averaged about 4 persons in size. About how many families were there in the United States in 1940?

2. According to the census the *exact* number of families was 34,854,532. Your answer to Problem 1 is only the *approximate* number of families. Is your answer more or less than the exact number? How much more or less is it?

To find one of the numbers that you need in Problem 3, you must look back at a problem already solved. Be sure that you answer both questions in Problem 3.

3. For each person in the United States in 1940 there were about 4 persons in the British Empire. About how many persons were there in 1940 in the British Empire? About how many more persons were there in the British Empire than in the United States?

4. There were 6,096,799 farms in the United States in 1940. The average number of acres per farm was 174. What was the approximate number of acres of farm land in 1940?

5. In 1790 the total land area of the United States was 867,980 square miles. In 1940 the total area was 2,977,128 square miles. This was an increase of how many square miles? Is 2,100,000 square miles a good approximate answer? Use this approximate answer to find the average increase in square miles per year for the 150 years.

6. The world's land area was about 19 times that of the United States in 1940. The world's land area was about how many square miles?

Problem 7 has two steps. Be sure to ask yourself the questions on page 16 for each step. In the first step you should find out how much of the rural population does not live on farms.

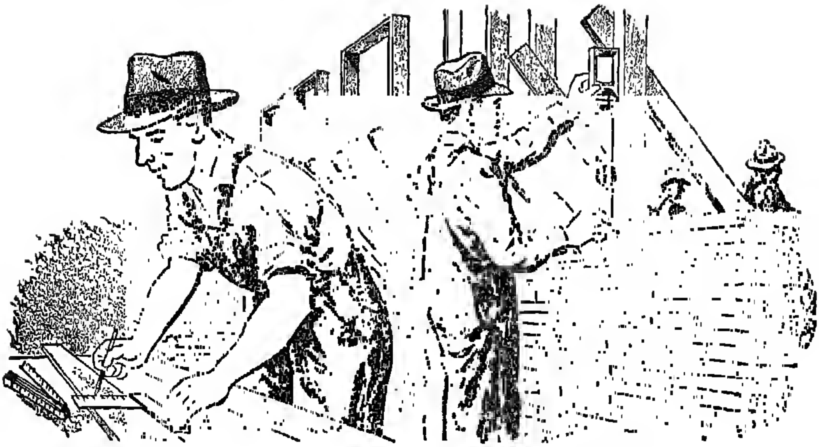
7. Persons who live on farms and in small towns are counted as rural population. The rural population of the United States in 1940 was 57,245,573. Of this number 47,902,896 lived on farms. Persons who live in larger towns and cities are counted as urban population. The urban population in 1940 was 74,423,702. How many persons in the United States did not live on farms in 1940?

A good plan in solving two-step problems is to make a question that asks what you are to find in the first step. What question should you ask for the first step in Problem 8?

8. In 1940 there were 7,454,995 persons living in New York City and 3,376,808 persons living in Chicago. How many of the 131,669,275 persons in the United States did not live in these two cities in 1940?

9. In 1800 there was an average of about 6 persons per square mile in the United States. In 1940 the average was about 44 persons. The average number of persons per square mile in 1940 was about how many times the average in 1800?

10. In 1940 a total of 26,759,099 persons were enrolled in schools in the United States. Of these persons 1,805,211 were under 7 years of age and 465,875 were over 21 years. How many persons between 7 and 21 years of age were enrolled in schools in the United States in 1940?



Important Measures

Long ago people did not need such exact measures as those used in building the house shown in the picture. The first measures that men used were such crude ones as the length of their feet, the length of their thumb joints, and the length of their arms. Of course these measures varied with the size of the persons. Much confusion and trouble were the result. To avoid this difficulty and confusion, we have in modern times agreed upon standard lengths for the foot, inch, and yard. Standards have been decided upon for all of the important measures that we use today.

1. In the tables on page 480 the stars show the measures that you have studied so far. Learn the starred measures that you do not know.

2. Make a list of all the different measures marked with stars on page 480. Begin with inch, foot, yard, and so on.

3. After each measure in your list write its abbreviation.

4. For each measure in your list write the name of something that is often measured by it.

What are the missing numbers below?

5. 2 yr. = __ mo., or __ wk.

6. 1944 and 1945 together had __ days.

7. 4 mi. = __ rd., or __ yd., or __ ft.

8. 367 oz. = __ lb. __ oz. 367 lb. = __ oz.

9. 1 day = __ hr., or __ min., or __ sec.

10. 8 T. = __ lb. 2 T. 1500 lb. = __ lb.

11. 103 qt. = __ bu. __ qt. 104 pk. = __ bu.

12. 15 yd. 2 ft. = __ ft. 67 ft. = __ in.

Sometimes in working with measures you get answers that are not in *simplest form.* For example, a length given as 25 ft. 28 in. is not in simplest form because the 28 in. can be changed to 2 ft. 4 in. The simplest form for 25 ft. 28 in. is 27 ft. 4 in.

Change the following to simplest form.

13.	5 lb. 67 oz.	12 hr. 80 min.	18 yd. 16 ft.
14.	10 bu. 44 pk.	14 gal. 64 pt.	9 T. 8990 lb.
15.	2 mi. 960 rd.	42 wk. 35 da.	4 da. 72 hr.

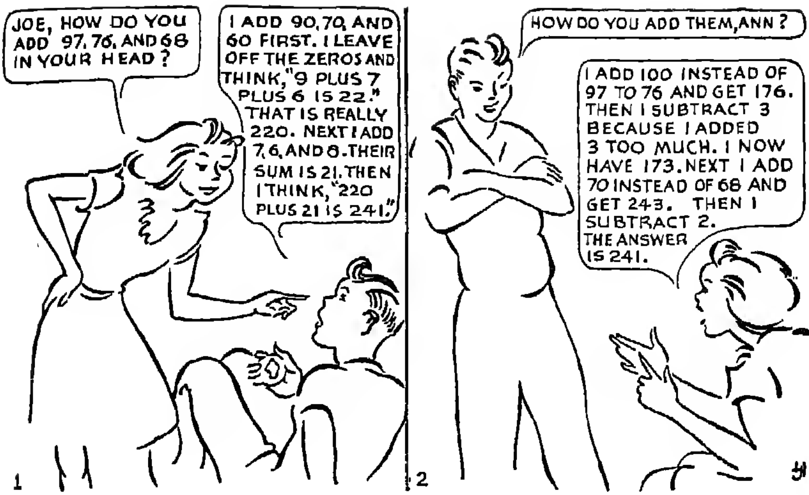
If you do not know how to work the examples below, turn to page 463 and do Self-Help Tests 39-42. Then use the Self-Help Practice on pages 464 to 467 for the review you need.

Be sure that your answers are in simplest form.

16. Add:	17. Subtract:	18. Multiply:
10 ft. 11 in.	7 bu. 2 pk.	8 lb. 9 oz.
16 ft. 8 in.	3 bu. 3 pk.	9

19. 58 min. 16 sec. ÷ 8

20. 20 gal. 2 qt. ÷ 2



Figuring in Your Head

There are times when you will find it very useful to be able to figure in your head without the help of paper and pencil. You must learn to be resourceful and to invent your own methods. Try out with your friends the ideas explained on these three pages.

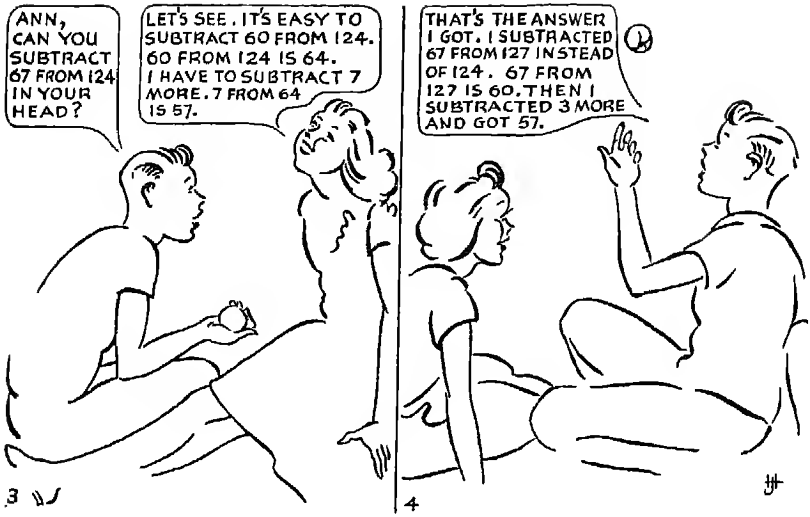
1. Look at Picture 1. Do you think Joe found a good way to add three numbers? Is his answer correct?

2. Now look at Picture 2. Why did Ann subtract 2 at the end of her work? Is her answer correct?

3. Which method do you like better, Ann's or Joe's? Why? Can you invent another method? It so, be prepared to explain it.

Read Example 4 below. Then close your book and add in your head. Do this for each of the other examples.

4. $52+57+64$	**6.** $87+71+58$	**8.** $39+85+62$
5. $27+69+76$	**7.** $91+88+47$	**9.** $46+98+19$



10. In Picture 3 Ann explains her method of subtracting in her head. Why did she subtract 7 from 64?

11. Use her method to subtract 45 from 131.

12. Look at Joe's method in Picture 4. Why did he use 127 instead of 124? Why did he subtract 3 from 60?

13. Use Joe's method to subtract 28 from 95.

14. Which method do you like, Ann's or Joe's? Why?

Read Example 15 below. Then close your book and subtract in your head. Do this for each of the other examples. Use Ann's, Joe's, or your own method.

15. 81 − 17	**18.** 49 − 27	**21.** 166 − 67
16. 184 − 96	**19.** 114 − 98	**22.** 73 − 36
17. 105 − 78	**20.** 151 − 67	**23.** 122 − 84

24. Joe and Ann had their own methods of multiplying. Look at Picture 5. Joe could have multiplied 32 by 10 and then by 8 and added the two answers. Try it. Is this way easier or harder than the way he did it?

25. Look at Picture 6. Why did Ann subtract 64?

26. Tom had another method to multiply 32 by 18. He multiplied 32 by 3. Then he multiplied that answer by 6. Should he have found the correct answer?

27. Tom multiplied by 3 and 6 because 18 is 3×6. He said he could have multiplied by 2 and 9. Try it.

28. Susan said that the answer could be found by first multiplying 18 by 4 and then multiplying that answer by 8. Was she correct?

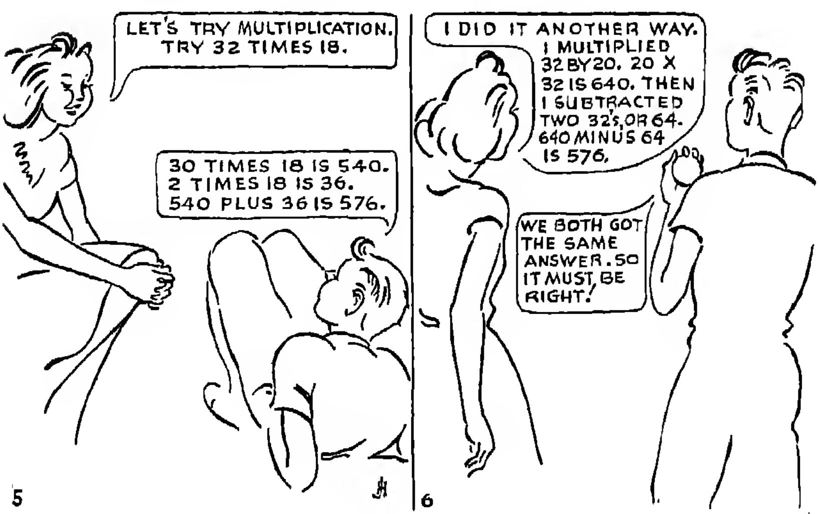
29. Now use Joe's, Ann's, Tom's, and Susan's methods to multiply 24 by 16. Which do you like best?

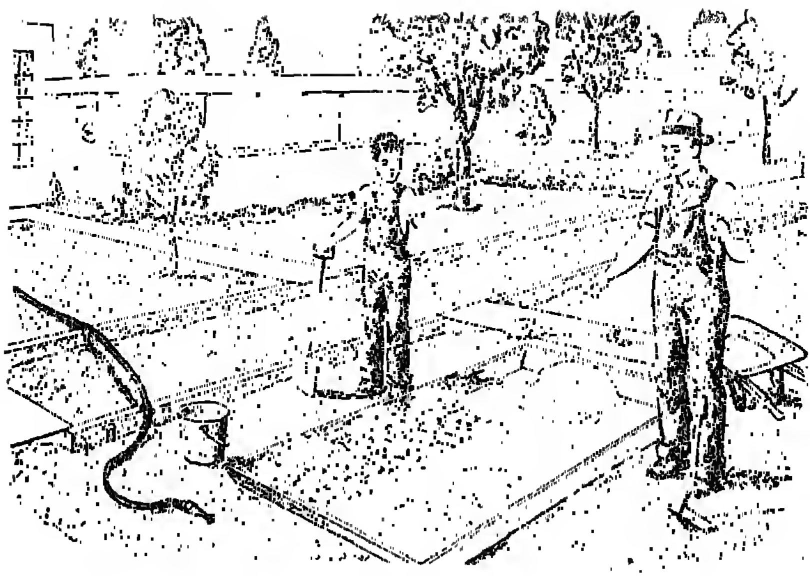
30. Is one method best for some examples and another method best for others?

31. Why could you not use Tom's method in multiplying 29 by 17?

Read Example 32 below. Then close your book and multiply in your head. Do this for the other examples.

32. 15×31	**35.** 11×22	**38.** 13×11
33. 23×41	**36.** 36×15	**39.** 24×28
34. 12×18	**37.** 91×21	**40.** 14×12





Using Common Fractions

Frank helped his father make a new concrete walk in front of their house. The picture above shows Frank and his father ready to mix the first batch of concrete. Mr. Gregg has dumped into the mixing-box 1 wheelbarrow load of cement, 2 wheelbarrow loads of sand, and 3 wheelbarrow loads of gravel.

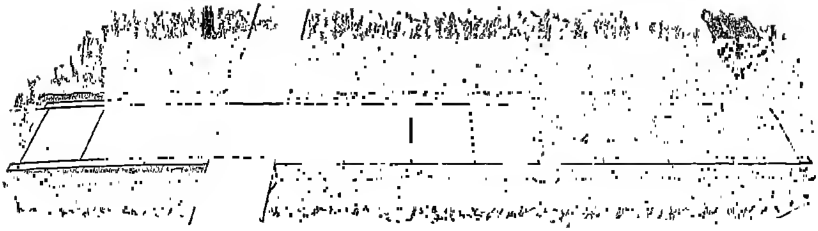
1. Why did he call this a "one, two, three" mixture?

2. Was the 1 load of cement $\frac{1}{6}$, $\frac{1}{5}$, $\frac{1}{4}$, $\frac{1}{3}$, or $\frac{1}{2}$ of the material in the box? How do you know?

3. Mr. Gregg said that $\frac{2}{6}$, or $\frac{1}{3}$, of the material in the box was sand. Why did he say "*two* sixths"?

4. The fractions $\frac{2}{6}$ and $\frac{1}{3}$ are equal. $\frac{1}{3}$ is the *simplest form* of $\frac{2}{6}$. The simplest form of $\frac{4}{6}$ is __.

5. Three wheelbarrow loads, or __ sixths, of the mixture were gravel. The simplest form for $\frac{3}{6}$ is __.



You should always change fractions in answers to simplest form. Pages 434-435 tell how to do this.

6. What is the simplest form for $\frac{2}{8}$, $\frac{4}{12}$, $\frac{4}{6}$, and $\frac{10}{25}$?

7. The picture above shows the whole walk. How many sections will there be in all? Frank and his father have finished how many sections?

8. To find what fraction of the walk they have finished, find what fraction 8 sections are of 12 sections. 8 is $\frac{8}{12}$ of 12. $\frac{8}{12}$ in simplest form is __.

9. What fraction of the walk is unfinished?

10. Each section of the walk is what fraction of the whole walk? Is your fraction in simplest form?

11. At the right is a picture of two trees in the Gregg back yard. Is the smaller tree about $\frac{1}{4}$, $\frac{1}{3}$, $\frac{1}{2}$, $\frac{2}{3}$, or $\frac{3}{4}$ as tall as the other one?

12. The smaller tree is 12 feet tall, and the other one is 16 feet tall. The smaller tree is $\frac{?}{16}$ as tall as the other tree.

13. What is the simplest form for $\frac{12}{16}$?

14. A tree 8 feet tall is __ as tall as the small tree.

15. This 8-foot tree is __ as tall as the larger tree.

16. Picture 1 below shows what fraction of a circle?

17. Half of a circle is a *semicircle.* Each part of Picture 1 is what fraction of a semicircle?

18. The upper half of Picture 2 is a __. Each part of the upper half of Picture 2 is what fraction of the semicircle? Of the circle?

19. In the lower semicircle of Picture 2 each part is what fraction of the semicircle? Of the circle?

20. Each part of Picture 1 is what fraction of a circle?

21. Is Picture 3 divided into fourths?

22. Is Picture 4 divided into fourths?

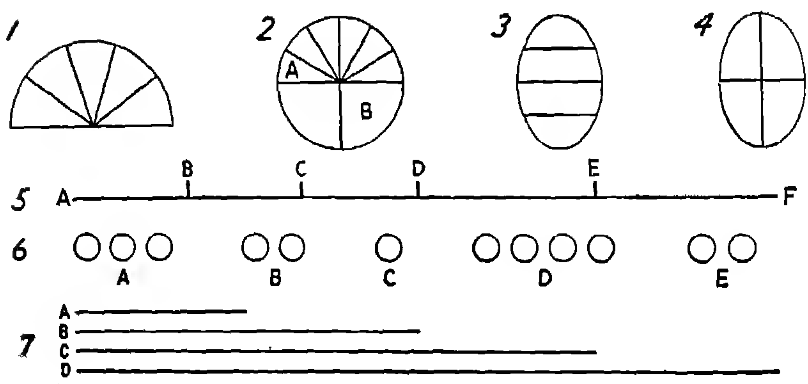
23. The line in Picture 5 is marked off into lengths. Give the fraction that each of the following distances is of the whole length A to F: A to D, D to E, A to B, E to F, A to E, D to F.

24. Look at each group of circles in Picture 6 and tell what fraction each group is of all the circles.

25. In Picture 7, Line A is what fraction of Line B? Of Line C? Of Line D?

26. Line B is what fraction of Line C? Of Line D?

27. Line C is what fraction of Line D?



Warming-Up Exercises in Fractions*

You must know how to add, subtract, multiply, and divide common fractions and mixed numbers to do this year's work in mathematics. Your teacher is going to give you some Review Tests so that you will know how well you can do this kind of work. After you have taken the tests, you will be given some practice if you need it.

Before you take the tests, do the four warming-up exercises below. Be sure that your answers are in simplest form.

1. Add:

				$\frac{3}{10}$	$7\frac{3}{8}$
5	$\frac{2}{3}$	$15\frac{1}{6}$	$\frac{4}{5}$	$\frac{7}{10}$	$4\frac{1}{8}$
$\frac{3}{5}$	$\frac{5}{6}$	$25\frac{3}{4}$	$7\frac{1}{2}$	$\frac{1}{3}$	$8\frac{3}{4}$

2. Subtract:

$\frac{11}{16}$	$14\frac{7}{8}$	$11\frac{1}{2}$	1	$9\frac{1}{3}$	$15\frac{7}{10}$
$\frac{3}{16}$	8	$10\frac{2}{3}$	$\frac{5}{12}$	$1\frac{5}{6}$	$11\frac{1}{2}$

3. Multiply:

$\frac{5}{6}\times\frac{1}{4}$	$5\frac{1}{10}\times9\frac{1}{6}$	$12\times\frac{5}{6}$	$\frac{1}{6}\times4$
$\frac{1}{2}\times\frac{2}{3}$	$1\frac{7}{8}\times6$	$1\frac{1}{5}\times\frac{5}{6}$	$\frac{5}{8}\times6\frac{4}{5}$

4. Divide:

$\frac{2}{3}\div\frac{5}{16}$	$\frac{2}{5}\div\frac{1}{2}$	$2\div\frac{4}{5}$	$\frac{9}{16}\div1\frac{7}{8}$
$4\div\frac{1}{8}$	$\frac{4}{5}\div2$	$9\frac{1}{3}\div\frac{3}{4}$	$7\frac{5}{12}\div\frac{1}{4}$

*To the Teacher: Give Review Tests 5, 6, 7, and 8 (pp. 417-419) after pupils have worked the fraction examples on this page. Then use the Self-Help Tests and Practice (pp. 436-454) for diagnosis and remedial work. Follow the plan that was indicated on page 13 for whole numbers.

The Three Ways to Use Fractions

The Becker family lives in the town of High River. At the time of the paper salvage drive last fall, the Beckers had saved 150 pounds of paper.

1. The three Becker children decided that each child should have $\frac{1}{3}$ of the paper to take to school. How many pounds of paper should each child have?

Should the answer be more or less than 150 lb.?

Don found how many pounds of paper he should have by multiplying 150 lb. by $\frac{1}{3}$. $\frac{1}{3} \times 150$ *lb.* = __ *lb.*

2. By the end of the day the school had collected 3600 lb. of paper. What fraction of all this paper had the Beckers contributed?

To solve Problem 2, you must find what fraction 150 is of 3600. Write 150 over 3600 as a fraction. $\frac{150}{3600}$ *in simplest form is* __.

3. The High River *Gazette* said that the 3600 lb. of paper salvaged by the school was $\frac{3}{10}$ of all the paper salvaged in High River that day. How much paper had been salvaged in High River that day?

Should your answer be more or less than 3600 lb.?

There are two ways in which you can find the answer for Problem 3. Since you know that $\frac{3}{10}$ of all the paper salvaged amounted to 3600 lb., then $\frac{1}{10}$ of the paper would amount to 3600 lb. $\div$ 3, or 1200 lb. $\frac{10}{10}$, or all of the paper salvaged, would amount to 10 $\times$ 1200 lb., or __ lb.

You can also solve this problem by dividing 3600 lb. by $\frac{3}{10}$. 3600 lb. $\div \frac{3}{10} =$ __ lb.

4. In which of the problems you have just solved did you find a fraction of a number? To find it, you __ the number by the __.

5. In which problem did you find what fraction one number was of another? How did you find it?

6. In which problem did you find a number when you knew what a fraction of it was? To find it, you __ the number by the __.

7. The *Gazette* also said that the businessmen in town contributed 4800 lb. of paper, or $\frac{2}{5}$ of the day's total of 12,000 lb. How was the fraction $\frac{2}{5}$ found?

8. About $\frac{1}{5}$ of the 150 lb. of paper that the Beckers had saved was made up of old magazines. About how many pounds of old magazines had they saved?

9. One truck picked up paper from private homes. It picked up 1575 lb. of newspapers, which was about $\frac{3}{4}$ of all the paper it picked up. This truck picked up about how many pounds of paper in all?

10. The Boy Scouts collected $\frac{1}{8}$ of the 12,000 lb. of paper salvaged that day. How many pounds of paper did the Boy Scouts collect?

How do you know without figuring that 96,000 lb. is the wrong answer for Problem 10?

11. One Scout collected 250 lb. of paper. This was what fraction of the paper collected by the Boy Scouts?

12. Tom collected 48 lb. of paper. This was $\frac{3}{4}$ as much paper as Joe collected. Joe collected __ lb.

How do you know without figuring that 36 lb. is the wrong answer for Problem 12?

13. 12 is __ of 32.

14. $\frac{3}{5}$ of 140 is __.

15. 72 is $\frac{4}{5}$ of __.

16. $\frac{7}{8}$ of 214 is __.

17. 95 is $\frac{5}{16}$ of __.

18. 60 is __ of 720.

19. 42 is $\frac{1}{5}$ of __.

20. $\frac{1}{10}$ of 1640 is __.

Think before You Answer

1. To find a number when you know a fraction of it, do you multiply or divide by the fraction?

2. When you divide by a proper fraction, is the answer larger or smaller than the number you divide?

3. Is the answer for Question 2 true when you divide a proper fraction by a proper fraction?

4. To find how much a fraction of a number is, do you multiply or divide by the fraction?

5. When you multiply by a proper fraction, is the answer larger or smaller than the number you multiply?

6. Is the answer for Question 5 true when you multiply a proper fraction by a proper fraction?

Using Decimal Fractions

Frank Wilson earns money by going on errands. When he uses his bicycle, he charges by the mile. In the picture Frank is reading the cyclometer on his bicycle. It shows the distance he travels.

The picture at the right shows the cyclometer as Frank is reading it before going on an errand. It shows that he has ridden his bicycle 136 and 7 tenths miles since he put the cyclometer on it.

The black figures mean miles. The white figure means *tenths* of a mile.

Frank wrote this mileage in his notebook, as shown at the right. He put a *decimal point* between the 6 and 7 to show that the 7 is a fraction. When you read this number, say "and" for the decimal point. Read the 7 as *7 tenths.*

136.7

Read the number as 136 __ 7 __.

136.7 is made up of the whole number 136 and the *decimal fraction* 7 tenths.

A number that contains a decimal fraction is called a *decimal number,* or simply a *decimal.*

138.0

At the right is the mileage that Frank wrote in his notebook when he had finished his errand. Read this number as *138 and no tenths*, or simply as *138*. Frank wrote the decimal point and the zero to make clear that there were no *tenths* of the next mile.

Whenever a number has just one figure at the right of the decimal point, read that figure as *tenths*. Such a number has *one decimal place*.

1. Row A below shows ten common fractions with the denominator 10. Row B shows them written as decimal fractions. Read the fractions in each row.

A	$\frac{1}{10}$	$\frac{2}{10}$	$\frac{3}{10}$	$\frac{4}{10}$	$\frac{5}{10}$	$\frac{6}{10}$	$\frac{7}{10}$	$\frac{8}{10}$	$\frac{9}{10}$	$\frac{10}{10}$, or 1
B	.1	.2	.3	.4	.5	.6	.7	.8	.9	1.0, or 1

2. Read each number in Rows C and D. As you read, tell whether a decimal fraction or a common fraction is used. Say "and" for the decimal point when it comes between figures.

Row C	12.5	.6	$21\frac{6}{10}$	6.7	.9	$\frac{7}{10}$
Row D	854.3	8.1	19.2	$3\frac{1}{10}$	$\frac{5}{10}$	$\frac{10}{10}$

.03

In making a booklet on "Milk Products," Alice Graham used many decimals. One of them is shown at the right. You read this number as *3 hundredths*. It means the same as $\frac{3}{100}$.

In .03 the zero is put between the decimal point and the 3 to show that the 3 means *3 hundredths* and not *3 tenths*. This number has *two decimal places*.

When there are two figures at the right of the decimal point, read the figures as *hundredths*.

3. Read each number in Rows E and F. Look carefully to see whether to say tenths or hundredths.

Row E	6.4	.72	400.2	.60	892.7
Row F	6.04	7.2	40.02	6.0	89.27

Alice also used some numbers with three decimal places. One of them is shown at the right. You read the number as *45 thousandths*. It means the same as $\frac{45}{1000}$.

.045

Alice used one number with four decimal places. It is shown at the right. Read it as *8 and 5985 ten thousandths*. It means the same as $8\frac{5985}{10000}$.

8.5985

4. Read each number in Rows G, H, and I.

Row G	7.02	8.3	.6435	.742	89.4
Row H	7.002	17.20	6.435	.64	8.04
Row I	7.0002	.052	892.41	.5	.8970

5. A decimal fraction of 3 places is read as __.

6. A decimal fraction of 4 places is read as __.

7. A decimal fraction of 1 place is read as __.

8. A decimal fraction of 2 places is read as __.

9. In which numbers in Rows J and K should the decimal point be read as *and?* Tell how many decimal places each of these numbers has.

10. Read each number in Rows J and K.

Row J	.473	.05	.9001	.6	241.603
Row K	1.90	1.07	13.601	.0001	47.0002

Write each of the following, using decimals.

11. 31 thousandths

12. 15 ten thousandths

13. 8 and 29 thousandths

14. 10 and 2 tenths

15. 10 and 2 hundredths

16. 10 and 2 thousandths

Warming-Up Exercises for Decimals*

You will have no trouble in working with decimals if you understand how to place the decimal point in the answer. All that you need to remember in addition and subtraction is to keep the decimal points in a straight column. Copy the examples below and find the answers.

Add:

1. .72+.85+.34+.69

2. 9.85+.68

3. 7.004+24.394+10.047

4. 6.7597+9.3104+.2708+77.2798+.5846

5. 98.1+4.0+.6+25.3

6. 6.05+.18+6.08

7. 87.2+94.3+81.0

Subtract:

8. .648−.223

9. 1.000−.986

10. 89.6−59.8

11. 605.0032−362.8941

Multiply:

12.	.62	.9375	9.567	4.8	284.97	6.351
	.86	80	735	.006	9	8.9

Divide:

13. $13\overline{).91}$ $\quad 4.5\overline{)9.90}$ $\quad 8\overline{)54}$ $\quad .24\overline{)3.36}$ $\quad 396\overline{)15.84}$

If you have trouble with the decimal points in addition and subtraction, use the Self-Help Practice on pages 455-456. Your teacher will now give you some Review Tests to show how well you can multiply and divide with decimals. You will be given some review and practice if you need it.

*To the Teacher: If a pupil shows that he needs practice in addition and subtraction of decimals, have him do the Self-Help Practice on pages 455-456. Then give Review Tests 9 and 10 (pp. 420-421). Next administer Self-Help Tests 32-38 (pp. 454-455) to those who need remedial work in multiplication and division of decimals. Follow this with the remedial practice (pp. 456-462) as indicated by the results of the tests.

Changing Fractions and Decimals

Henry read that $\frac{7}{8}$ of the homes in his town cooked with gas, .08 cooked with electricity, and the others with coal. What fraction of them cooked with coal?

To get the answer, you must either change $\frac{7}{8}$ to a decimal fraction or .08 to a common fraction.

1. The denominator of a decimal fraction is shown by the number of decimal places it has. One decimal place means that the denominator is tenths. When is the denominator hundredths? When is it thousandths?

2. $.08 = \frac{8}{100}$. What is the simplest form of $\frac{8}{100}$?

3. Why is it hard to add $\frac{2}{25}$ and $\frac{7}{8}$?

4. You can always change a common fraction to a decimal fraction by dividing the numerator by the denominator. Change $\frac{7}{8}$ to a decimal fraction.

5. Why may you think of .08 as equal to .080?

6. Why is it easy to add .080 and .875?

7. What fraction of the homes cooked with coal?

8. Are $\frac{1}{3}$, $.3\frac{1}{3}$, $.33\frac{1}{3}$, $.333\frac{1}{3}$, and $.3333\frac{1}{3}$ all equal?

9. If you were adding $\frac{1}{3}$ to .568, would you use $.3\frac{1}{3}$ or $.33\frac{1}{3}$ or $.333\frac{1}{3}$ or $.3333\frac{1}{3}$? Why?

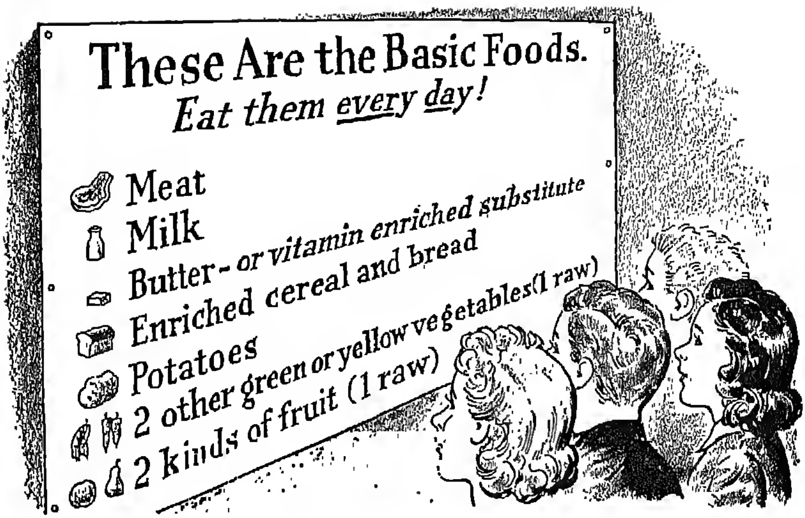
10. $\frac{2}{3}$ is closer to .67 than to .66. Why? Is $\frac{2}{15}$ closer to .13 or to .14?

11. Change the following to decimals with two places.

Row A	$\frac{4}{25}$	$\frac{7}{20}$	$\frac{5}{6}$	$\frac{7}{12}$	$\frac{3}{8}$	$\frac{8}{15}$	$1\frac{3}{5}$
Row B	$2\frac{3}{40}$	$\frac{5}{16}$	$4\frac{5}{18}$	$\frac{7}{50}$	$\frac{24}{25}$	$\frac{29}{36}$	$3\frac{1}{6}$

12. Change the following to common fractions or mixed numbers in simplest form.

Row C	.15	.04	2.35	.625	3.002	.48
Row D	.09	.004	3.75	.010	7.099	.60



The Three Ways to Use Decimals

Many mothers study foods and nutrition to learn how to feed their families properly. They learn about the proteins, carbohydrates, fats, minerals, and vitamins found in our foods. They also learn how to plan diets containing the proper amounts of all these things.

1. Protein is important in diets because it supplies energy and builds muscle and tissue. About .09 of the weight of enriched bread is protein. There are __ oz. of protein in a 1-lb. loaf of enriched bread.

Should the answer be more or less than 16 oz.?

You should multiply 16 oz. by .09 to find the answer. $.09 \times 16$ *oz.* = __ *oz.*

2. In 15 lb. of oatmeal there are 1.35 lb. of protein. Find the decimal fraction that tells what part of oatmeal is protein.

To solve Problem 2, you find what decimal fraction 1.35 lb. is of 15 lb. You should divide 1.35 by __.

3. In a certain quantity of bacon there are 44 lb. of protein. This protein is .16 of the total weight of the bacon. Find the total weight of the bacon.

Should your answer be more or less than 44 lb.?

There are two ways in which you can find the answer for Problem 3. Since .16, or $\frac{16}{100}$, *of the bacon weighs 44 lb.,* $\frac{1}{100}$ *of it weighs* $\frac{1}{16}$ *of 44 lb., or 2.75 lb.* $\frac{100}{100}$, *or all, of the bacon weighs 100 times 2.75 lb., or __ lb.*

You can also get the answer by dividing 44 lb. by .16. 44 lb.÷.16= __ lb.

4. In which of the three problems that you have just solved did you find a decimal fraction of a number? To do this, did you multiply or divide the number by the decimal fraction?

5. In which problem did you find what decimal fraction one number is of another? How did you find it?

6. In which problem did you find a number when you knew what a decimal fraction of it was? To do this, did you multiply or divide the number by the decimal fraction?

After you have solved each of the following problems, be prepared to explain whether the question in Problem 4, Problem 5, or Problem 6 applies to it.

Before you do any figuring in Problem 7, decide whether the answer should be more than or less than 2 lb. Be prepared to explain how you know.

7. .009 of the weight of American cheese is calcium, a mineral that helps to build bones and teeth. About what is the weight of the calcium in 2 lb. of American cheese?

8. Dried whole milk contains considerable calcium. In 16 oz. of such milk there is .144 oz. of calcium. The calcium is what decimal fraction of the weight of the milk?

.144 oz. is what decimal fraction of 16 oz.? Do you divide .144 by 16, or do you divide 16 by .144?

9. A chemist found that a certain quantity of eggs contained .009 lb. of phosphorus, which is another important food mineral. The phosphorus was .002 of the total weight of the eggs. Find the total weight of the eggs.

Should your answer for Problem 9 be more than or less than .009 lb.? How do you know? Should you multiply or divide by .002?

10. Mr. West, who does moderately active work, needs 2.3 oz. of protein a day. On Thanksgiving Day he figured that he had eaten 12 oz. of turkey, of which .211 was protein. Had he eaten enough turkey to supply the protein he needed for that day?

11. John West, who is 14 years old and still growing, needs 2.8 oz. of protein a day. How many ounces of turkey would he need to eat to supply all the protein he needs for one day? Give your answer to the nearest whole ounce.

12. Little Bobby West is only 5 years old. He needs .033 oz. of calcium a day. He ate about 3 oz. of oatmeal for breakfast one morning. Oatmeal is about .0001 calcium. He got about __ oz. of calcium in the oatmeal. Do you think he could eat enough oatmeal to get all the calcium he needs?

13. Hazel West, who is 10 years old, needs .033 oz. of calcium a day. How many ounces of bread, which is .0003 calcium, would she have to eat to supply all the calcium she needs for one day?

14. .26 of 82 is __.

15. 16 is .25 of __.

16. 30 is __ of 80.

17. .28 is .5 of __.

18. 125 is __ of 75.

19. 7.44 is .03 of __.

20. 98 is 1.75 times __.

21. 1.92 times .8 is __.

22. .89 of 14.7 is __.

23. 1.08 is __ times .9.

24. 1.45 times 64 is __.

25. 363.3 is 1.05 times __.

Think before You Answer

1. If you know how much .24 of a number is, how do you find the number?

2. Is the number larger or smaller than the amount you know? Why?

3. If you know how much 1.24 times a number is, how do you find the number?

4. Is the number larger or smaller than the amount you know? Why?

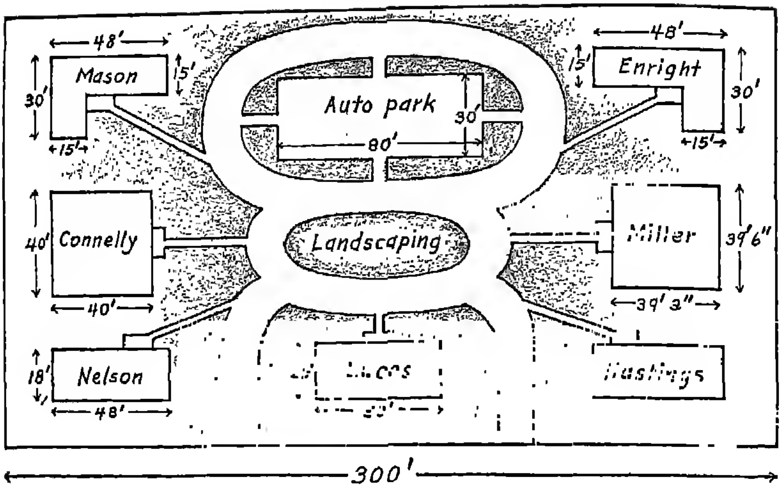
5. How do you find .24 of a number?

6. Should the answer be larger or smaller than the number? Why?

7. How do you find 1.24 times a number?

8. Should the answer be larger or smaller than the number? Why?

9. When you find what decimal fraction one number is of another, are you really comparing the two numbers? Explain your answer.



Squares and Other Rectangles

The plan above shows a group of homes arranged so that each house has a fair share of space and light.

The plan has four straight sides and four square corners. A square corner is a *right angle.* The plan is a *rectangle* because it has four straight sides and because each of its four corners is a right angle.

A rectangle is a figure in which all four sides are straight lines and all four angles are right angles.

1. Look at the floor plan of the Hastings house. Is it a rectangle? How do you know?

2. For which houses are the floor plans not rectangles? How do you know?

The *length* and the *width* of a rectangle are its *dimensions.*

The dimensions of the Nelson house are shown on the plan. The dimensions of the house are 18 feet *by* 48 feet. This house is 18 ft. wide and 48 ft. long.

3. How do you know that the dimensions on the plan for the Nelson house are in feet and not in inches?

4. What are the dimensions of the Lucas house? Of the Auto Park?

5. Why is it wrong to say that the dimensions of the Enright house are 30 ft. by 48 ft.?

6. Why is it correct to say that the floor of the Enright house is really two rectangles?

7. If you give the dimensions of one of the rectangles as 15 ft. by 30 ft., what should you give as the dimensions of the second rectangle?

8. Give the dimensions of another set of two rectangles that will describe the floor of the Enright house.

Another way to write the dimensions of a rectangle is shown at the right. Read the letter *x* as *by*. The width of the rectangle is usually written first.

15′ x 30′

9. Write the dimensions of the Connelly house, the Nelson house, and the Lucas house in this way.

10. The floor plan of the Connelly house shows that its length and width are equal. The floor of this house has __ sides each 40 ft. long. How many right angles does this floor have?

The floor of the Connelly house is a *square* because its four straight sides are all equal in length and its angles are all right angles.

A square is a rectangle that has all four sides equal in length.

11. Is the floor of the Miller house a square?

12. What part of the Enright house can you think of as a square? Why?

13. At one time the seven families decided to plant a low hedge all around the piece of land on which the houses are built. Before ordering the hedge, they found the *distance around* the piece of land. They added 300′, 300′, 160′, and 160′. Why did they use 300 ft. twice and 160 ft. twice?

The distance around a rectangle or square is called its perimeter.

14. What is the perimeter of the Nelson house?

15. To find the perimeter of the Connelly house, you can multiply 40′ by 4. Why can you multiply by 4?

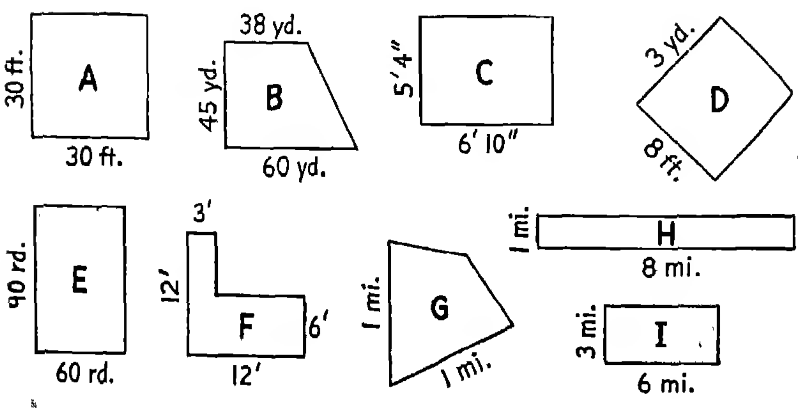
16. The dimensions of the Hastings house are 18′ 10″ by 48′ 10″. What is its perimeter? Be sure that your answer is in simplest form.

17. What is the perimeter of the Miller house?

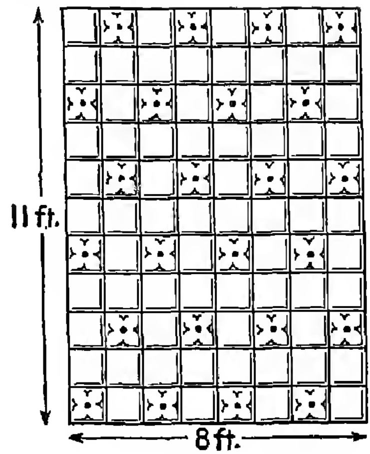
18. Which of the diagrams below are not rectangles? How do you know? Which are squares?

19. Find the perimeter of each rectangle below.

20. Find the distance around Figure F.



Areas of Rectangles



The Mason house in the plan on page 40 has a porch 8 ft. by 11 ft. Mr. Mason made a floor for it by laying square tiles in cement The picture at the right shows what the floor looked like.

Each tile used in the floor is a square 1 foot by 1 foot. Each tile covers *1 square foot* of the floor. The *area* of each tile is 1 square foot.

The abbreviation for *square foot* is *sq. ft.* You may write the area of each tile as *1 sq. ft.* The abbreviation for *square feet* is also *sq. ft.*

The area of a figure is the amount of surface that it covers.

The picture shows that Mr. Mason laid the tiles in 8 rows with 11 tiles in each row. He used 8 times 11 tiles, or __ tiles. Since each tile has an area of 1 sq. ft., the porch floor has an area of __ sq. ft.

Another way to find the area of the rectangular porch floor is to multiply its length by its width, as in Example A. Remember that the answer is *square feet,* not *feet.*

A

$8 \times 11 = 88$,
or 88 sq. ft.

To find the area of a rectangle, multiply its length by its width.

When you find area, always be sure that *both* dimensions are in inches, or in feet, or in yards, or in rods, or in miles before you multiply.

The units commonly used for measuring area are *square inch, square foot, square rod, square yard.*

Mr. Mason's living room is 14 ft. by 22 ft. 9 in. To find the cost of carpet to cover the entire floor, he had to know its area.

Example B shows that the first thing Mr. Mason did was to change 22 ft. 9 in. to $22\frac{3}{4}$ ft. Why did he do this?

B
14 ft. by 22 ft. 9 in. =
14 ft. by $22\frac{3}{4}$ ft.
14 ft. × $22\frac{3}{4} = 318\frac{1}{2}$,
or $318\frac{1}{2}$ sq. ft.

What numbers did he multiply to get the area?

How did he know that the answer was in square feet, not square inches?

1. The carpet was sold by the square yard; so next he changed $318\frac{1}{2}$ sq. ft. to square yards. He divided $318\frac{1}{2}$ sq. ft. by 9 because 1 sq. yd. = 9 sq. ft.

2. Should he have bought 35 sq. yd. or 36 sq. yd. of the carpet? Why?

3. Why did he divide by 9 instead of multiply by 9?

4. Draw a diagram to show that 1 sq. yd. equals 9 sq. ft.

5. Learn the table below so that you will know what number to use when you change one unit of square measure to another unit of square measure. Be sure that you understand when to multiply and when to divide in changing one unit of measure to another.

144 sq. in. = 1 sq. ft.	9 sq. ft. = 1 sq. yd.
160 sq. rd. = 1 A.	640 A. = 1 sq. mi.

6. Change 5 A. to square rods. Change 4 sq. mi. to acres.

Find the answers to Problems 7, 8, and 9. Then look at Self-Help Examples C, D, and E to see whether or not your work is correct.

7. The Nelson house is 18′ by 48′. What is the area of its floor?

8. The Nelsons' kitchen is 10 ft. 3 in. by 12 ft. 9 in. What is the area of the floor?

9. The Auto Park is 10 yd. by 80 ft. How many square feet of surface does it cover?

C	D	E
$18 \times 48 = 864$, or 864 sq. ft.	10 ft. 3 in. by 12 ft. 9 in. = $10\frac{1}{4}$ ft. by $12\frac{3}{4}$ ft. $10\frac{1}{4} \times 12\frac{3}{4} = 130\frac{11}{16}$, or $130\frac{11}{16}$ sq. ft.	10 yd. by 80 ft. = 30 ft. by 80 ft. = $30 \times 80 = 2400$, or 2400 sq. ft.

10. The Miller house is 39′ 3″ by 39′ 6″. What is the area of the floor in square feet?

11. Why is it more sensible to find the area of a floor in square feet than in square inches?

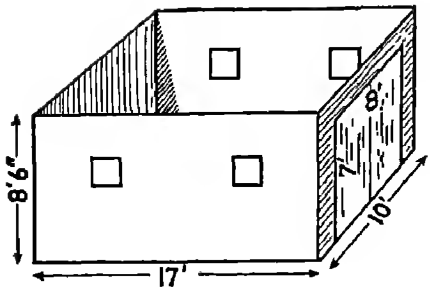
12. John bought 12 sq. in. of metal foil that cost $15.80 per square foot. How much did it cost?

13. In solving Problem 12, why is it more sensible to change 12 sq. in. to a fraction of a square foot than to find the cost of 1 sq. in. of the foil?

14. At the bottom of page 42 are some diagrams. Find the area of each rectangle.

15. Find the area of the Enright house, shown in the plan on page 40. Look at Problems 6, 7, and 8 on page 41 for help if you need it.

Problems about Rectangles



Mr. Lee used this diagram in planning repairs for his garage.

1. In figuring the cost of a cement floor, should he use the perimeter or the area of the floor? Why?

2. In buying new glass for the windows, should he tell the store man the dimensions, the perimeter, or the area of each window? Why?

3. What are the dimensions of the whole front wall?

4. What are the dimensions of the back wall?

5. What are the dimensions of the side walls? Do they both have the same dimensions? Why?

6. What are the dimensions of the floor?

7. The roof is flat and extends 6″ beyond the walls on all sides. What are its dimensions?

8. How much will a cement floor cost Mr. Lee at $1.75 per square yard?

9. Each window has an opening 1′ 9″ square. To find how much weather stripping is needed to go around each window, should he find the perimeter or the area? Why?

10. How much will the weather stripping cost for all four windows at $1\frac{3}{4}$¢ per foot?

11. Three of the windowpanes are broken. Each pane is 9″ by 18″. Can these 3 panes be cut from a piece of glass 9″ wide and 63″ long? How do you know?

12. How much glass will be left over?

13. Which answer for Problem 12 is better, 81 sq. in. of glass or a piece 9″ square? Why?

14. Mr. Lee is going to nail felt strips along the bottom of the garage doors to prevent drafts. The strips are sold in yard lengths only, at 19¢ each. How much will the strips cost?

15. Mr. Lee plans to paint the roof with roof paint. How many square feet of roof will he paint?

16. Each gallon of paint will cover about 80 sq. ft. of surface. Mr. Lee has decided to buy 3 gal. About how much paint should he have left over?

17. At 75¢ per gallon, how much will the roof paint cost?

18. Before buying the paint for the outside walls, Mr. Lee must figure the area of the walls. Why should he include the doors?

19. What is the total area of the walls?

20. In figuring the area, Mr. Lee thought of the four walls as one wall $8\frac{1}{2}$ ft. high. He should have thought of this one wall as how many feet long?

21. Each gallon of wall paint should cover about 350 sq. ft. of surface. Should he buy 1 gal. 1 qt. or 1 gal. 2 qt. of paint? Why?

22. The paint sells at the rate of $3.50 per gallon and 95¢ per quart. How much will it cost?

23. If Mr. Lee can save 35¢ by buying only 1 gal., 1 qt., and 1 pt. of the paint, why might he still buy 1 gal. and 2 qt. of the paint?

Without Pencil

	A	B	C	D	E	F
1.	6 is $\frac{1}{4}$ of____.	$.9\times 58$	Find the average: 22, 10, 13.	8 yd. 24 ft. =____yd.	$\frac{3}{16}+1\frac{5}{16}$	Area of a 6 in. square is ____ sq. in.
2.	$7\overline{)945}$	$\frac{3}{8}\times 1\frac{1}{2}$	82 74 77	$\frac{27}{4}$ in simplest form is___.	$168-75$	$4\overline{).92}$
3.	$\frac{1}{4}$ = what decimal fraction?	$.96-.67$	$6+4+55$	6 lb. 20 oz. =____lb. ____oz.	Perimeter of a 7-in. square is _____in.	Subtract: $3\frac{7}{10}$ $2\frac{4}{5}$
4.	24 ×18	$7\times\$3.50$	54 sq. ft. = ____sq. yd.	$\frac{5}{6}\div\frac{5}{12}$	$.8=\frac{4}{?}$	$84\overline{)756}$

Learning through Practice

1. $938\times 674=$
2. $6\times\frac{5}{12}=$
3. 27 into $7965 =
4. $4386\div 56=$
5. $130064-8368=$
6. Divide $\frac{3}{4}$ by $\frac{1}{12}$.
7. $\frac{5}{8}$ times $\frac{4}{5}=$
8. $\frac{7}{8}\div\frac{1}{4}=$
9. $.002\times 174=$
10. 168 plus 84 plus 3500 =
11. Add 7, $6\frac{3}{8}$, and $4\frac{1}{4}$.
12. $\$6.98+\$.59+\$.25+\$.05=$
13. Multiply .078 by 10.
14. 8.193 minus 3.708 =
15. $56\times\frac{1}{8}=$
16. $24\frac{7}{16}$ minus $15\frac{3}{4}=$
17. $\frac{5}{6}\times\frac{2}{3}=$
18. $.82+3.05+72.19=$
19. Find the sum of 42.3, 86.0, 71.5, and 90.6.
20. $3\frac{7}{16}$ multiplied by 8 equals what?
21. How many times does 2.6 go into 12.012?
22. Find the difference between $8\frac{1}{3}$ and $2\frac{5}{6}$.

CHAPTER 2

Earning a Living for the Family

Ways of Earning a Living

The persons in the picture above earn their livings in different ways. The first man in the line at the window is a doctor. He has several checks that he has received from patients. The girl holding her pay envelope in her hand is a stenographer. The man behind her is a machinist in an airplane factory. He has a check for two weeks' work. The man at the desk is a farmer. He has sold cattle, eggs, and fruit and has received cash and checks in payment for them.

Workers like the doctor, the stenographer, the machinist, and the farmer help to earn the incomes of American families. There are more than 30 million families in the United States, and each of these families must have an income.

Men and women work at hundreds of different jobs to earn the incomes they need for themselves and their families.

A great number of these incomes come entirely from wages or salaries that are paid at certain regular times. Some workers receive their pay once a week; others, once a month; still others, twice each month. These workers are paid at different rates, too. Some of them receive a certain amount per hour. The rates of others are figured by the day, by the week, by the month, or by the year.

But there are also large groups of workers who do not receive a regular wage or salary. This is true of many salesmen, who are often paid according to how much they sell.

Farmers and merchants, too, receive no salaries. Their incomes come largely from the products they raise or sell. Doctors and lawyers, as a rule, receive the largest part of their incomes from fees that they charge their patients and clients.

Some families do not have to depend on earnings for their incomes. Such families usually get their incomes from investments, that is, from property that they own and from interest on money that they loan to others. Many families in this country have incomes from both earnings and investments.

Much of the figuring that you will do during your lifetime will be in connection with the money you earn and spend. You will need to keep records of what you earn, to estimate how much you expect to earn, and to check on the accuracy of the amounts paid you.

1. Persons in your community are earning their livings in many different ways. Think of these different ways and list the ones that interest you most.

2. In which of these occupations are workers paid by the day?

3. In which occupations are they paid by the hour?

4. In which occupations are they paid by the week?

5. In which occupations are the workers paid according to the amount of work they do?

6. Why do some workers earn more than others?

7. The pencil that you are using cost perhaps $3\frac{1}{2}$¢. It took the work of lumbermen, miners, manufacturers, and many others to make this pencil. Each of these persons got part of his living from the $3\frac{1}{2}$¢. How can so many different persons earn a living from something that costs so little?

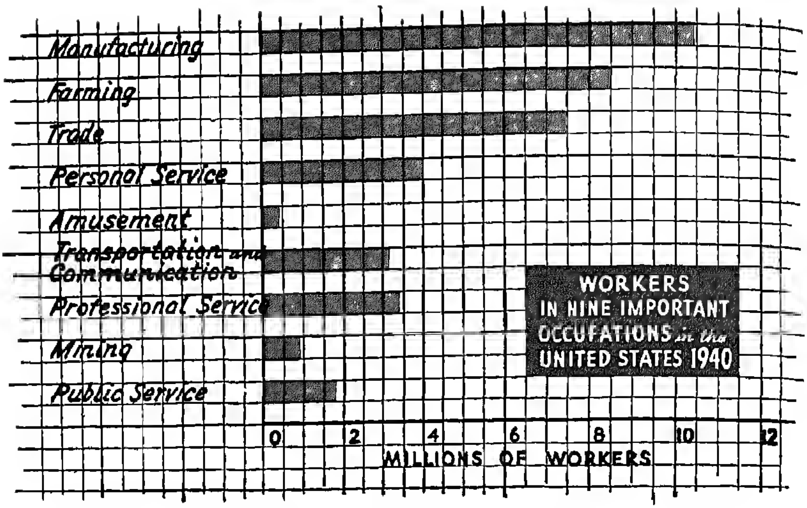
8. How can you help increase your family's buying power without earning any money?

9. What are you doing now to increase your chances of earning a good income later on?

10. Even if your mother does not work for a wage or a salary, she still helps very much to increase the buying power of her family. How is this possible?

11. Do you think that money invested in government bonds can increase a family's income? Why?

12. Many large stores sell goods to their clerks for less money than they would have to pay for the same goods elsewhere. If a clerk does all his buying at his store, how has he increased his buying power?



Reading Bar Graphs

The *bar graph* above tells you certain things about the workers of the United States in nine occupations in 1940. How does the graph show that manufacturing had more workers that year than any other occupation?

The numbers are placed below the heavy line at the bottom of the graph to make the *scale*. The scale shows the number of workers represented by bars of different lengths. The numbers on the scale mean millions of workers. The scale begins with 0 and goes to 12 millions because the longest bar must show more than 10 million workers. Each small space along the heavy bottom line represents $\frac{1}{2}$ million workers.

1. The bar for manufacturing goes almost one small space beyond the 10-million line. How do you know that about $10\frac{1}{2}$ million persons worked in manufacturing industries in 1940?

2. The bar for farming ends almost 1 small space beyond the 8-million line. About __ persons were farmers.

3. About how many persons worked at mining in the United States in 1940?

4. The *title* of the graph is "Workers in Nine Important Occupations in the United States 1940." The title tells you two facts that are not shown anywhere else on the graph. What are these two facts?

5. On this graph the bars go straight across the page. Bars or lines drawn in this position are *horizontal.* So graphs with horizontal bars are *horizontal bar graphs.* How many horizontal bars are there?

6. In the graph below, the bars run straight up and down. They form right angles with the heavy horizontal line. Bars or lines in this position are *vertical.* Why is the graph called a *vertical bar graph?*

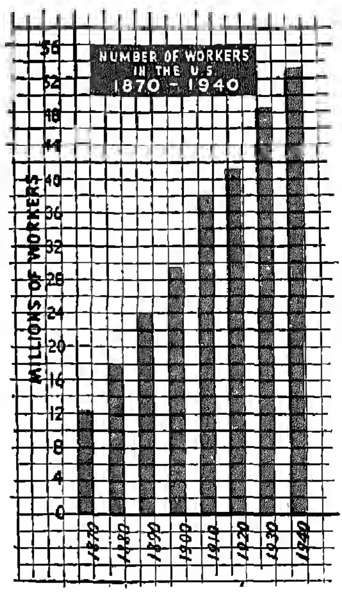
7. The numbers are placed along the vertical line to make the scale. This scale is in ___ of workers and goes from ___ to ___ millions.

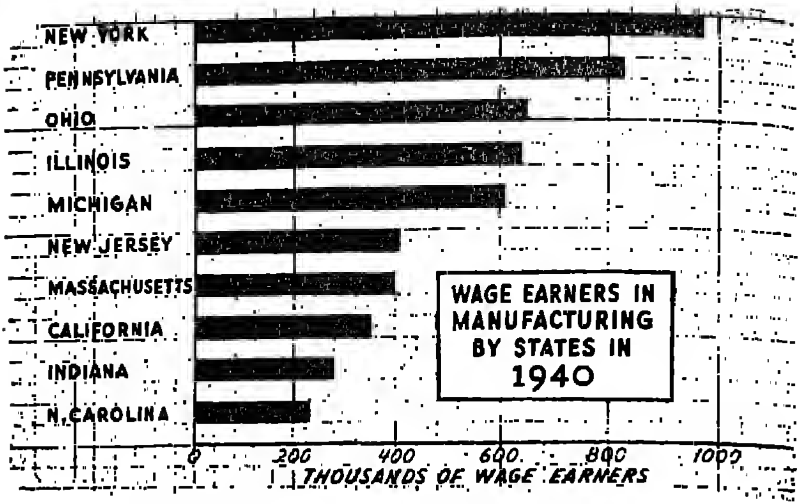
8. What do the numbers under the heavy horizontal line mean?

9. Each space along the vertical scale represents ___ workers. How did you get this figure?

10. There were about ___ more workers in the United States in 1940 than in 1870.

11. Is the following statement correct? According to the graph, the number of workers increased constantly each ten years from 1870 to 1940.





12. What kind of bar graph is shown above? According to the title, what information does it give you?

13. The scale along the bottom line is given in __ of wage earners. The 200 means __ wage earners.

14. How does the graph show that the ten states are arranged in order from the state with the largest number of wage earners to the state with the smallest number?

15. In 1940 the exact number of wage earners in manufacturing for Illinois was 637,213. The exact number for Ohio that year was 652,102. Because these figures were rounded off to the nearest ten thousand before the graph was drawn, the bars for these two states show very little difference. Does this matter? Why?

16. If the bars for two states on this graph were equal in length, could the actual difference in the numbers of wage earners be larger than 5000? Why?

17. For each state on the graph, give the approximate number of wage earners in manufacturing in 1940.

Exercises in Reading Bar Graphs

In the picture below, Miss Ross has just finished drawing a bar graph on the blackboard.

1. What is the title of this graph? How does the title help you to read and understand the graph?

2. Why did Miss Ross put 9, 10, 11, and 12 opposite the bars on her graph?

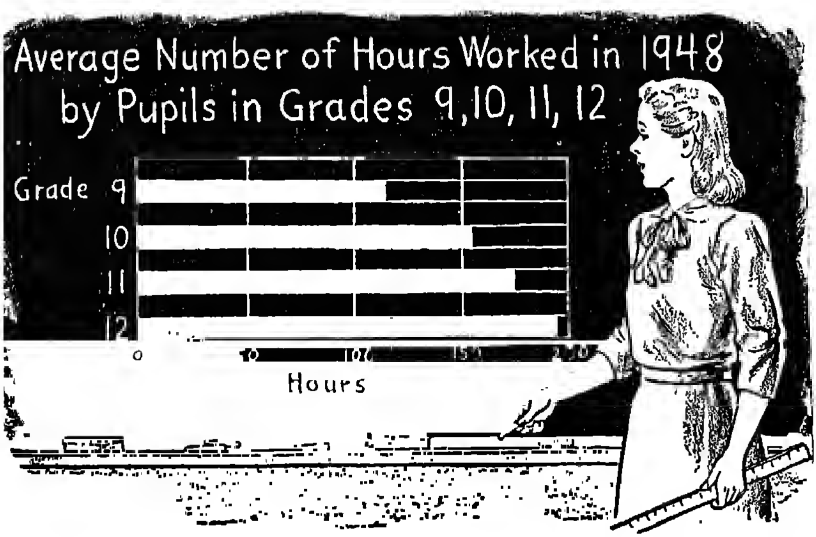
3. What do the numbers on the scale mean?

4. How can you tell that the pupils in Grade 9 worked an average of about 115 hours in 1948?

5. The pupils in Grade 12 worked an average of about __ hours that year.

6. Is the following statement correct according to the graph? The higher the grade, the greater was the average number of hours worked.

7. Which grade had the greatest increase over the preceding grade in average number of hours worked?



8. The picture below shows Miss Ross holding up a bar graph for the class to see. What is missing from this graph?

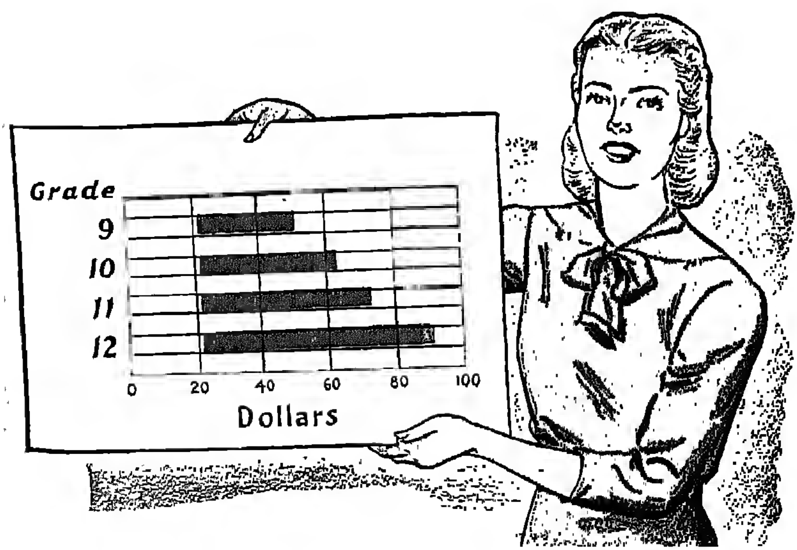
9. Miss Ross explained that the graph showed the average amount earned by pupils in Grades 9, 10, 11, and 12 in 1948. What would have been a good title for the graph?

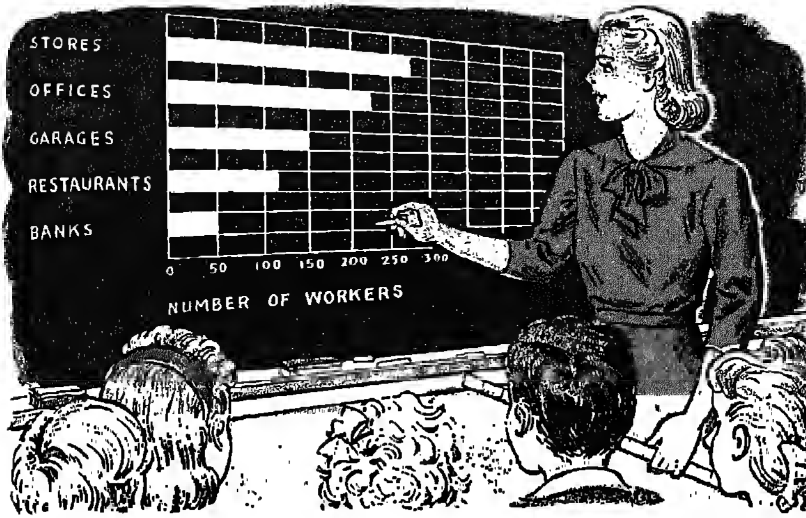
10. Miss Ross also explained that for each grade the amount earned is given to the nearest dollar. Is the average amount earned by pupils in Grade 9 about \$25 or about \$30? How do you know?

11. What is the approximate average amount earned by pupils in Grade 10? In Grade 11? In Grade 12?

12. In which grade was the average amount earned about three fourths as much as in Grade 12?

13. Which grade had the greatest increase over the preceding grade in average amount earned?



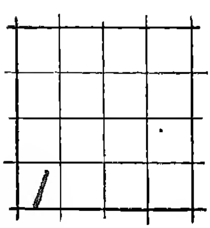


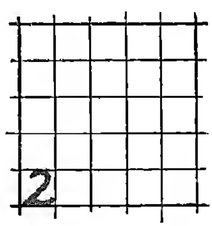
Making Bar Graphs

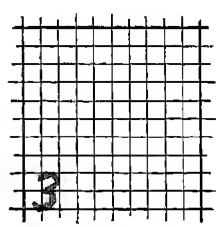
The picture above shows how Miss Ross made a graph on the blackboard when her class studied the different ways of earning a living. Is the graph on the board a horizontal or a vertical bar graph?

The pupils made other graphs at their desks. For these graphs they used several kinds of *squared paper*, called *graph paper*. Samples of three kinds of squared paper are shown below.

1. On all three kinds of graph paper the heavier lines are 1 in. apart. The lighter lines are $\frac{1}{4}$ in. apart on the first kind. How far apart are the lighter lines on the other two kinds of graph paper?







Income of 100 Families

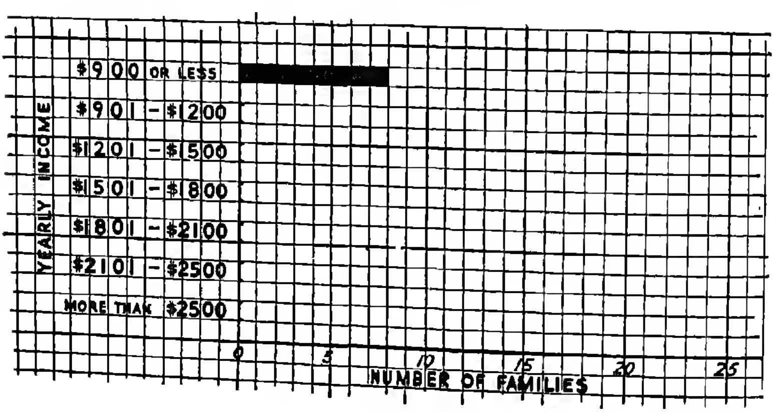
Yearly Income	No. of Families
$900 or less	8
$901 – $1200	16
$1201 – $1500	24
$1501 – $1800	19
$1801 – $2100	14
$2101 – $2500	12
More than $2500	7

2. Bob Harvey read an article giving the incomes of 100 families in his town. He decided to make a graph that would show this information. So Bob arranged the facts in the table shown at the left. What does the first column show? What does the second column show?

He planned to make each bar 1 square wide and to leave 1 square of space between each two bars. He thought this arrangement would make a neat graph.

3. Bob knew that he should make a bar for each group of yearly incomes in his table. You can see below how he marked his graph paper to show where each bar should start. Then he put the amounts of the incomes along the left side of his graph. Why did he put "Yearly Income" at the side of these amounts?

4. Next Bob decided on the scale to use. The table showed that his longest bar would be for the 24 families with incomes from $1201 to $1500. His scale had to show at least __ families.



Bob's graph paper was marked with heavy lines 1 in. apart. It was also marked with lighter lines in such a way that there were 5 small squares to the inch.

5. Bob decided that each inch should represent 5 families. Then each small square would represent how many families?

6. He planned to use 25 as the last number on his scale. Why did he plan to use 25 instead of 20?

7. Could Bob have let each inch represent 1 family? If he had done this, how long would his longest bar have been?

Notice that he wrote 0, 5, 10, 15, 20, and 25 for his scale. He started his scale at 0 because he knew that if his scale did not begin with 0, the graph would not be a true picture of what it is supposed to show.

8. Why did Bob print "Number of Families" under his scale?

9. He made the first bar 8 squares long. Was this correct? How do you know?

10. The next bar should be __ squares long. Decide how long each of the other five bars should be.

11. When Bob had finished drawing all the bars, he put this title on the graph: "Income of 100 Families in Fairview in 1948." Does this title tell you anything that the graph does not? Is it a good title? Is it better than the title of the table? Why?

12. If Bob had had to show 50 families on his graph, he might have used a different scale. Why? Could he have marked his scale 0, 10, 20, 30, 40, and 50? Then each small square would have represented __ families.

Average Farm Wages per Month, Including Board

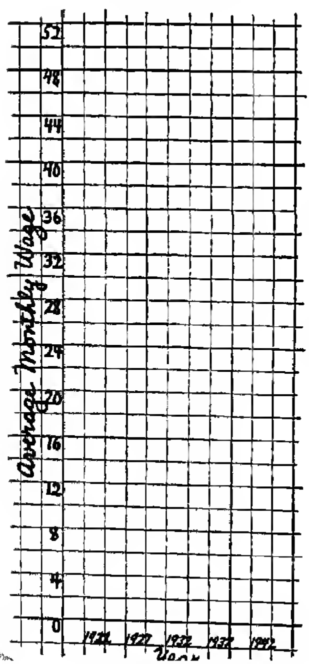
Year	1922	1927	1932	1937	1942
Average wage	$32.75	$40.11	$20.85	$27.73	$46.64
Rounded wage	$33	$40	$21	$28	$47

13. Jean Taylor made a graph about farm wages. She first made the table shown above. Could she have arranged the facts differently? How?

14. The average wage for 1922 was $32.75. Jean rounded off each wage to the nearest dollar. Why? Did she round off each year's wage correctly?

15. You can see below how Jean started her graph. Was it to be a horizontal or a vertical bar graph?

16. What was the longest bar she had to draw? Why did she decide to let each square on the scale represent $2?



17. Could she have ended her scale with 48 instead of with 52? Why?

18. Did she write the scale correctly? Why did she number her scale by 4's instead of by 2's?

19. How many squares wide did she plan to make each bar? How much space did she plan to leave between each two bars?

20. Make a vertical bar graph of the facts in Jean's table. You may use any scale that will work out well. Put a title on your graph.

Bar Graphs to Make

Some of the facts that Miss Ross's pupils used when they made graphs are given on this page and the next. Make a table and a graph for each set of facts.

1. For five years the average earnings of workers in the lumber business were: 1939, \$990; 1940, \$994; 1941, \$1091; 1942, \$1291; 1943, \$1613.

When you make the table for Problem 1, it should have three columns. Label the first column "Years." Label the second column "Yearly Wages." Label the last column "Rounded Wages." Round off each yearly wage to the nearest hundred dollars.

Does it matter whether you make a horizontal bar graph or a vertical bar graph for Problem 1? How many bars should you make?

Your scale should begin at 0 and go to at least __. Would this scale work out well for you: 0, 500, 1000, 1500, 2000? Where should you print "Average Wage per Year"?

What is a good title for your graph?

2. In 1925 the average price for chickens received by farmers in the United States was 18.5¢ per pound. In 1930 it was 19.8¢ per pound; in 1935, 12.3¢; in 1940, 12.0¢; and in 1943, 22.1¢.

What kind of bar graph can you make of the facts in Problem 2?

Round off the prices to the nearest whole cent. Will 19¢, 20¢, 12¢, 12¢, and 22¢ be the correct prices?

Try 0, 4, 8, 12, 16, 20, 24 for the scale. Does the scale represent "chickens," "pounds," or "cents"?

Remember to put a title on your graph.

3. 305,000,000 gal. of ice cream were made in the United States in 1939. 318,000,000 gal. were made in 1940; 390,000,000 gal. in 1941; 462,000,000 gal. in 1942; and 412,000,000 gal. in 1943.

When you make the graph for Problem 3, let each small square on your graph paper represent 20,000,000 gal. Will this scale be correct: 0, 80, 160, 240, 320, 400, 480? Why should you label the scale "Millions of Gallons"?

4. Average weekly earnings in the paint and varnish industry for five years were as follows: 1937, \$27.59; 1938, \$27.21; 1939, \$28.48; 1940, \$29.26; 1941, \$32.35.

Think before You Answer

1. Could you make a bar graph without squared paper? Explain your answer.

2. Henry said that one bar on a graph showed that in 1944 the population of Ottumwa County was 120,010. The scale of the graph was shown in 10 thousands. What do you think was wrong with the way Henry read the graph?

3. If you wanted to keep a record of the money you earn each month this year, would you make a graph or would you write the amounts in table form? Explain your answer.

4. The largest amount that Joe is to show on a graph is \$9121. The scale is marked \$1000, \$2000, \$3000, and so on. Should the last amount on the scale be \$9000 or \$10,000? Why?

5. Why would a scale marked \$100, \$200, \$300, \$400, and so on, not be a good one for Joe's graph?

Without Pencil

	A	B	C	D	E	F
1.	$7\frac{1}{2}=\frac{?}{2}$	Subtract: 124 75	$78\overline{)15.6}$	18 in. = ____ ft.	Divide 7qt. 1pt. by 3.	$3.75\div100$
2.	Multiply: 8.9 .5	$\frac{1}{4}+\frac{1}{6}$	$.6\overline{).006}$	.0009 = what common fraction?	$4-3\frac{3}{5}$	$\frac{3}{4}\times\frac{5}{8}$
3.	42 63 74 10	100×3.75	$\frac{5}{8}\div5$	$5\div\frac{5}{8}$	17yd. 5ft. =____ft.	Find the average: 7, 5, 0, 6, 12.
4.	Area of a floor 12′ by 18′ is ____.	75 is $\frac{1}{4}$ of____.	$3\frac{1}{3}\times\frac{1}{6}$	45 is what fraction of 100?	$7\frac{1}{2}$ $8\frac{1}{4}$ $5\frac{1}{8}$	$2\frac{1}{2}\times8$

Learning through Practice

1.	.9		5.8		8.985	5.85
	3.8	7.40	.6	.286	.439	9.07
	4.6	.93	1.1	.068	5.076	.65
	72.9	6.82	4.5	.899	.270	8.32

Find the answers correct to the nearest thousandth:

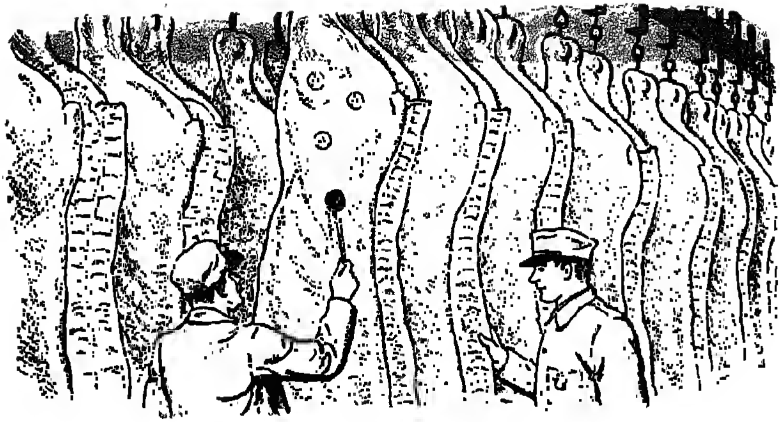
2. $.4\overline{).08}$ $.8\overline{).14}$ $8.1\overline{)72}$ $28\overline{)21}$ $.285\overline{)1995}$

3. $.9\overline{)64}$ $52\overline{)5.9}$ $.36\overline{).027}$ $37.4\overline{)69}$ $1.72\overline{)1.1}$

Find the answers:

4. $2\frac{1}{4}\div\frac{3}{16}$ $\frac{3}{4}\times1\frac{1}{2}$ $\frac{1}{8}\times6\frac{2}{3}$ $3\div\frac{2}{3}$ $\frac{9}{10}-\frac{3}{5}$

5. $\frac{3}{8}+\frac{9}{16}$ $2\frac{3}{8}\div3$ $4\frac{1}{6}-\frac{3}{5}$ $8\frac{1}{3}+\frac{3}{4}$ $\frac{5}{6}\times\frac{9}{10}$



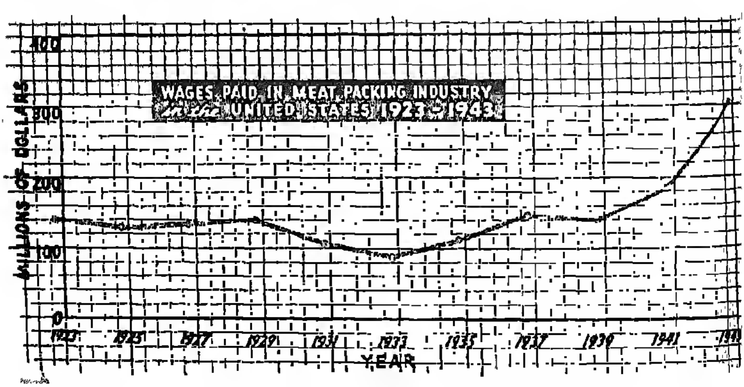
Reading Line Graphs

Many thousands of workers earn their livings preparing the meat we eat. Some are inspectors who examine the meat to see that it is pure and healthful.

The graph below shows the money earned in each of 11 years from 1923 to 1943 by workers in meat-packing plants. This graph is called a *line graph* because a line is used instead of bars.

This graph has two scales. The numbers on the vertical scale represent millions of dollars. The numbers on the horizontal scale represent years.

When one scale of a line graph is in years, the graph must show facts for each year marked on the scale.



1. Each small space on the vertical scale represents how many dollars?

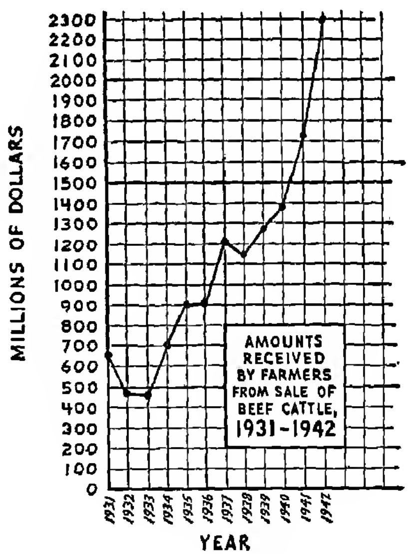
2. Find the dot on the vertical line for 1931. It is a little more than one and one-half spaces above the horizontal line for $100,000,000. How does this show that a little more than $130,000,000 was earned in 1931?

3. About how much was earned in 1933?

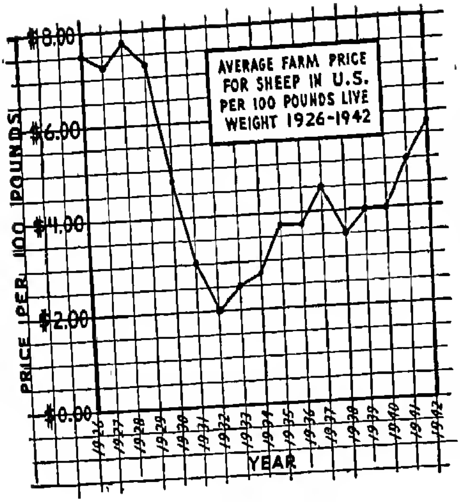
4. Make a table showing the approximate earnings for each year as indicated on the graph.

5. By looking at the line on the graph, you can see when the total wages decreased or increased. The graph shows a small decrease from 1931 to 1933. How does the graph show this? Is a large decrease or a large increase shown anywhere on the graph? Does the line from 1939 to 1943 go up or down? Did the total wage decrease or increase from 1939 to 1943?

6. The graph at the right shows the amounts received by farmers from the sale of beef cattle during the years from 1931 to 1942. How does it show that approximately $480,000,000 was received for beef cattle in 1932?



7. Make a table of the approximate amounts received by farmers for beef cattle each year from 1931 to 1942.



8. Part of the farm income in the United States comes from the sale of livestock. The amount of many farmers' incomes, therefore, depends partly upon the price they receive for their livestock. This graph shows changes in the price farmers received for their sheep. These changes are shown for each year from __ to __.

9. Look at the vertical scale. Each price given on this scale is for how many pounds? Are these prices for live sheep or butchered sheep?

10. What is shown on the horizontal scale?

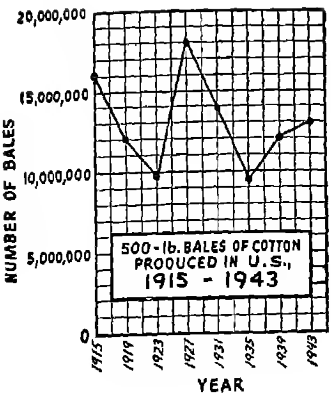
11. According to the graph, what happened to the price of sheep between 1928 and 1932? What happened to the price between 1932 and 1935?

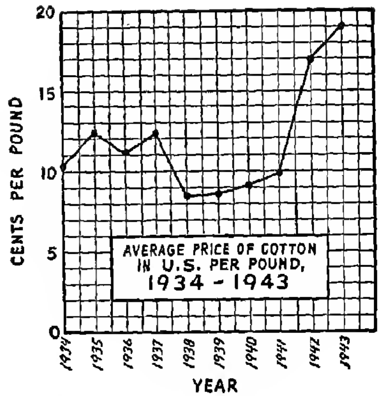
12. In what year was the price of sheep highest? In what year was it lowest?

13. In what years did the price of sheep increase? Did it ever rise as high as, or higher than, it was in 1928?

14. What is the approximate difference between the highest price and the lowest price shown on the graph?

15. Do you think that the price in 1943 was higher than, lower than, or about the same as the price received in 1942? What is there about the graph that makes you think so?





Line Graphs to Read

1. Look at the graph at the left above. In what units does it show the amount of cotton produced? Could you find from it the approximate number of pounds produced?

2. Between 1915 and 1923, the production of cotton dropped from about __ bales to about __ bales.

3. In what two years shown on the graph above did cotton production drop below 10,000,000 bales?

4. Cotton production was highest in __. It amounted to about __ bales that year.

5. What does the other graph show?

6. The average price of cotton in 1934 was a little less than 10.5¢ per pound. How does the graph show this?

7. In what two years was the price of cotton approximately 12.5¢ per pound?

8. The price of cotton per pound continued to rise between __ and __.

9. The greatest increase in price per pound for one year was between __ and __.

YEARLY SALE OF CRANBERRIES							
YEAR	1937	1938	1939	1940	1941	1942	1943
NUMBER OF BARRELS	315	170	252	204	258	288	242
NUMBER OF BARRELS (ROUNDED)	320	170	250	200	260	290	240

Making Line Graphs

Jim Hunt's father has ten acres of cranberry bogs. He gets a large part of his income each year by selling cranberries. The table above, which Jim made from his father's records, shows how many barrels of cranberries his father sold each year for seven years.

1. Why did Jim round off the number of barrels for each year? How did Jim get the 320? The 250? The 290? He rounded off the numbers to the nearest __.

2. From this table Jim made the line graph on the next page. He planned his graph so that he had places for __ years on the horizontal scale. Notice that he allowed the same amount of space between the years. Why did he allow so much space between the years?

3. The largest amount Jim had to show was __ barrels.

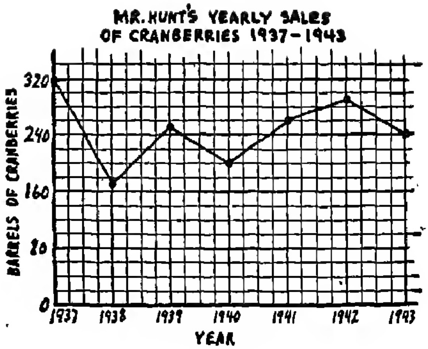
4. He decided that each four spaces on his graph paper should represent 80 barrels. Then each small space would represent __ barrels.

5. Jim marked the vertical scale at each 80-barrel line. Did he mark it correctly?

6. Did he label the two scales correctly?

7. Jim next placed a dot on the graph for each year. Each dot showed how many barrels of cranberries had been sold that year. How many dots did he place?

8. The first dot was for 1937. Jim placed this dot where the vertical line for 1937 crosses the horizontal line for __ barrels. Why?



9. The position of this dot shows that __ barrels of cranberries were sold in 1937.

10. Jim placed the next dot on the line for 1938, about half a space above the 160-barrel line. How does this dot show that Mr. Hunt sold 170 barrels in 1938?

11. Why did Jim place the dot for 1939 about half a space above the 240-barrel line? This dot shows that Mr. Hunt sold __ barrels in __.

12. Is the dot for 1940 placed correctly? What does it show? Are the dots for 1941, 1942, and 1943 placed correctly?

13. As soon as Jim had placed all the dots, he drew the lines that connect them. Could you read the graph if the dots were not connected by lines? How do the lines help you to see the increases and decreases in Mr. Hunt's sales?

14. What title did Jim give his graph? Is it a good title? Can you think of a better one?

15. Is it correct to say that Mr. Hunt's yearly sales of cranberries varied between 170 barrels and 320 barrels during the years 1937-1943?

16. At the top of the next page is another table that Jim made from his father's records. What does it show?

YEARLY AVERAGE PRICE OF CRANBERRIES

YEAR	1937	1938	1939	1940	1941	1942	1943
PRICE PER BARREL	$8.75	$10.98	$9.85	$12.37	$11.71	$12.45	$16.60
PRICE PER BARREL	$8.50	$11.00	$10.00	$12.50	$11.50	$12.50	$16.50

17. Jim rounded off each price to the nearest 50¢. How did he get \$8.50? \$10.00? \$11.50?

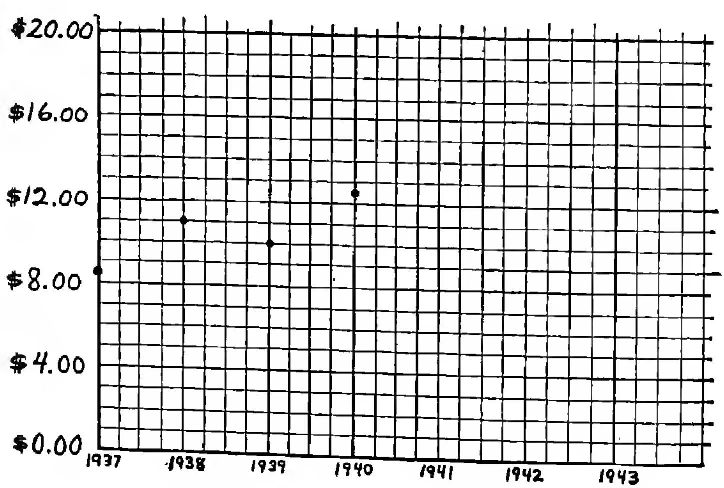
18. You can see below how he began work on a line graph of these prices. Did he allow equal amounts of space between the vertical lines representing years?

19. Does the vertical scale begin with 0? Does it include the highest price received? Each large space represents \$__. Each small space represents \$__.

20. Should Jim have labeled this scale? If so, how?

21. Did he place the first 4 dots correctly?

22. Make a line graph of the prices in Jim's table. Use the same scale that he did. Place all the dots and join them. Be sure to put a title on your graph.



Line Graphs for You to Make

1. The average price of lettuce per 70-pound crate for 9 months in 1943 was: Jan., \$3.45; Feb., \$3.70; March, \$3.40; April, \$4.25; May, \$4.30; June, \$3.75; July, \$2.10; Aug., \$2.65; Sept., \$2.95. Make a three-column table for these facts. Label the first column "Month." Label the second column "Price per Crate." Label the third column "Rounded Price per Crate." Round off each price to the nearest 25 cents.

2. Make a line graph from the table for Problem 1. The scale should begin at \$0 and go to at least \$__. Try \$0, \$2, \$4, \$6 for the scale. If it does not work out well for you, what other scale can you use? Where should you put "Average Monthly Price per Crate"? Be sure to put a title on your graph.

3. The total cash farm income for 5 years in the United States was as follows: 1933, \$5,445,000,000; 1935, \$7,659,000,000; 1937, \$9,217,000,000; 1939, \$8,684,000,000; 1941, \$11,830,000,000. Make a table of these facts. You may round off the amounts to the nearest billion dollars.

4. Make a line graph from the table for Problem 3. Can you use the scale 0, 2, 4, 6, 8, 10, 12? Remember to label the scale "Billions of Dollars." Why is this important? What is a good title for this graph?

5. The average amount of ice cream eaten per person in the United States in each of 8 years was: 1928, 8.0 lb.; 1930, 7.8 lb.; 1932, 5.0 lb.; 1934, 5.7 lb.; 1936, 7.4 lb.; 1938, 8.5 lb.; 1940, 9.4 lb.; 1942, 12.7 lb. Make a table of these facts. Show the amounts first exactly and then rounded off to the nearest whole pound.

6. Make two graphs for the facts in Problem 5. Use the exact figures for one graph and the rounded-off figures for the other. Can you use the same scale?

7. Compare the two graphs that you made for the facts in Problem 5. Are they different? If so, in what way? Is the difference important?

8. John's father kept a record of John's height for several years. At age 9 he was 3 ft. 9 in. tall; at age 10, 3 ft. 11 in.; at age 11, 4 ft. 1 in.; at age 12, 4 ft. 5 in.; at age 13, 4 ft. 10 in. Make a table and line graph of these facts. Would it be better to round off the heights to the nearest foot or to change the heights to inches? Why?

Think before You Answer

1. Which would be easier to draw without squared paper, a bar graph or a line graph? Why?

2. How might you make a line graph if you did not have squared paper?

3. Is a line graph more like a vertical bar graph or a horizontal bar graph? Explain your answer.

4. In rounding off 2,499,999 to the nearest million, would you give it as 2,000,000 or as 3,000,000? Why? Does it really make any great difference? Why?

5. If it does not make any great difference, why would it usually be rounded off to 2,000,000?

6. If the largest amount that you are to show on a graph is $100,000,000, would you show your scale in 1 millions, 5 millions, or 10 millions? Why?

7. Why are graphs often spoken of as pictures?

Problems about Wages

1. Bill White's father works in a furniture factory. He is paid 88¢ per hour. Last week he worked $39\frac{1}{2}$ hr. How much did he earn last week?

2. Miss Thomas, a department store clerk, earned $27.24 in one week. This amount included $7.74 more than her weekly base salary because of large sales she had made. What was her weekly base salary?

3. Dave Preston had a summer job wiring lamps in a lamp factory. He was paid 5¢ for each lamp that he wired. How many lamps did he have to wire to earn one week's wages of $18.00?

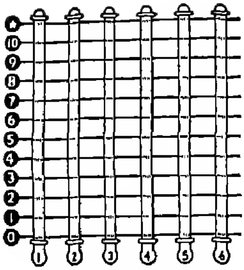
4. Mr. Logan's regular working week is 40 hours. He is paid at the rate of $1.10 per hour. When he works more than 40 hours in one week, he is paid "time and a half" for the overtime. This means that each hour of overtime is counted as $1\frac{1}{2}$ hours. During one week in December Mr. Logan worked 51 hours. For how many hours should he have been paid at the rate of $1.10?

5. How much did he earn that week?

6. Barbara Henry's father received a pay envelope containing $34.63 for one week's work. This amount did not include $2.57 taken out for his withholding tax, social security tax, and insurance. What was the total amount of his wages that week?

7. Mr. Henry is paid at the rate of 93¢ an hour. How many hours did he work that week?

8. In 1860, $2 was a good wage for 12 hours' work by a laborer. How much was that per hour?



Self-Testing Drill 1

This is the first of fifteen Self-Testing Drills that you will have this year. Wait for your teacher to tell you when to begin. You will have just *20 minutes* to work.

Use pencil and paper for this drill. If you find an example that you can work without copying, write only the answer on your paper.

If you finish before your teacher says "Stop," try "A Side-Trip in Mathematics" on page 75.

Example 19 is wrong if you have any part wrong.

1. $\frac{1}{2}+\frac{3}{4}+\frac{5}{8}=$

2. Find $\frac{2}{3}$ of $\frac{1}{2}$.

3. Subtract:
$$\begin{array}{r} 1198291 \\ \underline{403856} \end{array}$$

4. Find the difference between 68535.9 and 12794.6.

5.
$$\begin{array}{r} 490 \\ 443 \\ 476 \\ 369 \\ 521 \\ \underline{738} \end{array}$$

6. Helen said that the correct answer to 1,365,919 minus 580,457 was 785,462. Betty said it was 885,462. Which girl was right?

7.
$$\begin{array}{r} 47.5 \\ 84.0 \\ 836.5 \\ 16.7 \\ 673.8 \\ \underline{33.4} \end{array}$$

8. $20\frac{1}{4}$ is how much more than $15\frac{5}{6}$?

9. $2\frac{5}{6}\div 2=$

10. Multiply:
$$\begin{array}{r} 820.6 \\ \underline{.512} \end{array}$$

11. Multiply:
$$\begin{array}{r} 8207 \\ \underline{963} \end{array}$$

12. Add:
$$\begin{array}{rr} 2 \text{ ft.} & 7 \text{ in.} \\ 1 \text{ ft.} & 9 \text{ in.} \\ & 11 \text{ in.} \\ \underline{2 \text{ ft.}} & \underline{3 \text{ in.}} \end{array}$$

13. From 14 bu. 2 pk. subtract 6 bu. 3 pk.

14. Multiply:
$$\begin{array}{r} 4 \text{ ft. } 9 \text{ in.} \\ 8 \\ \hline \end{array}$$

15. $53488.8 \div .612 =$

16. $798\overline{)4575}$

17. Divide 5 ft. 4 in. by 4.

18. Without actually dividing, decide whether 1000, 100, or 10 comes nearest to being the correct answer for the following example: $492.016 \div 4.91$.

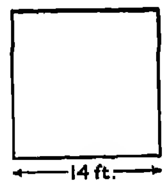
19. (*a*) $\frac{14}{4}$ in simplest form is __.

(*b*) $\frac{20}{6}$ in simplest form is __.

(*c*) $\frac{22}{8}$ in simplest form is __.

(*d*) $\frac{16}{6}$ in simplest form is __.

20. Find the area of the square shown at the right.



A Side-Trip in Mathematics

The addition method shown in the example below was used many years ago. The method is still useful, especially for adding long columns of figures. It makes checking easy by showing the sum of each column.

The sum for the ones' column is 21. Write the 21 so the 1 is in the same column as the figures added.

Next find the sum of the tens' column. What is this sum? Where do you write it?

The sum of the hundreds' column is __. Where do you write this sum?

How do you get 2051?

Now turn to page 14 and find the answers to the examples by this method.

$$\begin{array}{r} 897 \\ 356 \\ 798 \\ \hline 21 \\ 23 \\ 18 \\ \hline 2051 \end{array}$$

How Well Did You Do?

How many of the 20 examples in Drill 1 did you work correctly? The paragraphs printed under the Standards below tell you how to use the Standards in finding your rating for Drill 1.

Standards for Self-Testing Drill 1

Number Correct	0	1–6	7–8	9–10	11	12	13	14	15–16	17	18–19	20
Rating	0	1	2	3	4	5	6	7	8	9	10	★

The star rating is the best rating you can get. To get the star rating on Drill 1, you must have all 20 examples correct. If you have 18 or 19 examples correct, your rating is 10.

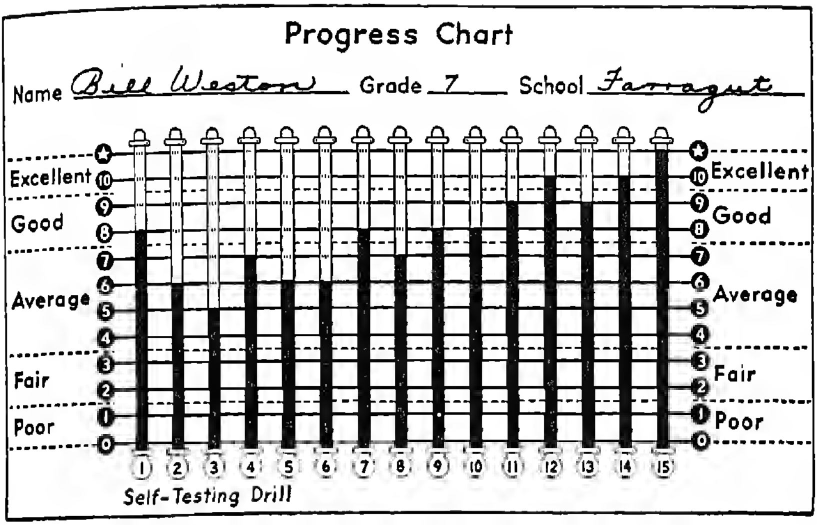
What would your rating be if you had 11 examples correct? What would it be if you had 16 correct? If you had only 4 correct?

What is your rating on Drill 1?

How to Make a Graph of Your Ratings

Look at the bar graph at the top of page 77. It shows Bill Weston's ratings on all the Self-Testing Drills. How well did Bill do on Drill 1? He had 15 examples correct on Drill 1. The Standards above show that the rating for 15 correct examples is 8. To show that his rating was 8, Bill filled in Thermometer 1 up to the line marked 8. How can you tell by the graph that Bill's work was *Good?*

If Bill had answered only 10 examples correctly, should he have filled in the thermometer up to the line marked 10 or to the line marked 3? Why? Would his work have been *Fair* or *Average?* How do you know?



Was your work on Drill 1 *Excellent, Good, Average, Fair,* or *Poor?*

Now find a Progress Chart on pages 469 to 472.

Fill in Thermometer 1 up to the line that shows your rating on Drill 1. Did you do as well as Bill?

Learning through Practice

Find each answer to the nearest thousandth unless it comes out exactly in tenths or hundredths:

1. $3\overline{).08}$ $\quad 1.5\overline{).7}$ $\quad 5.5\overline{)14.3}$ $\quad 4.2\overline{)1.08}$ $\quad 22\overline{)1.882}$

2. $7\overline{)6}$ $\quad 1.7\overline{)6}$ $\quad 4.2\overline{)8}$ $\quad .04\overline{).2004}$ $\quad .39\overline{).8596}$

Multiply:

3.	.7	.083	618	25.9	$8.60	43.6	1070
	.4	.6	50	49	96	3.15	36

4.	6.4	90	.748	$9.00	.409	.827	419
	.2	5.4	.08	807	76	35.9	204

What must I find? Add? Multiply? Divide? Why?
Shall I subtract? What numbers shall I use?

Problem Test 1

This problem test will tell you how well you can solve problems. For each problem that you solve correctly you will earn the number of points shown at the end of the problem. For Problem 1 you can earn 3 points; for Problem 2, 4 points; and so on. You will have seven of these problem tests during the year.

1. During one morning at the dress-goods counter Miss Barr sold the following amounts of cloth: $3\frac{1}{2}$ yd., $2\frac{1}{3}$ yd., $4\frac{2}{3}$ yd., and $5\frac{1}{4}$ yd. What were her total sales of cloth in yards that morning? (3)

2. The Troy Real Estate Company bought 1264 A. of land and divided it into farms. At the first sale of this land, Mr. Jones bought 76 A.; Mr. Burns, 134 A.; Mr. Beck, 89 A.; Mr. Lee, 270 A.; and Mr. Gray, 307 A. How many acres of this land were left for sale? (4)

3. Mary Anderson read that about .25 of a dressed beef carcass is round steak. About how many pounds of round steak can be cut from a dressed beef carcass weighing 784 lb.? (5)

4. Mr. Frye will buy the lot advertised at the right if its area is large enough for his lumber yard. What is the area of the lot in square feet? (5)

5. Before Jim Kyle and his three friends went on a 3-day hike, they estimated that their food would cost each of them 30¢ a meal for three meals a day. They found that their food actually cost $27\frac{3}{4}$¢ a meal. Their total estimate was how much too large? *(5)*

6. The boys weighed their knapsacks at one country store where they stopped. Jim's knapsack weighed $12\frac{1}{2}$ lb.; Roy's weighed 17 lb. 8 oz.; Walt's weighed 14 lb. 9 oz.; and Jerry's weighed 16 lb. 4 oz. What was the combined weight of the four knapsacks? *(5)*

7. Five eighths of a yard of black calico is needed for each of the pirate hats to be worn in the junior high school operetta. How many of these hats can be made from $17\frac{1}{2}$ yards of black calico? *(5)*

8. The distance from Boston to London is 3641 mi. The distance from Boston to New York is 232 mi. It is how many times as far from Boston to London as it is from Boston to New York? Give your answer correct to one decimal place. *(6)*

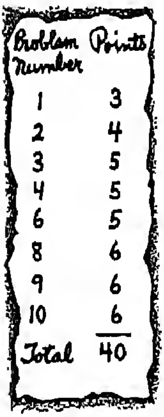
9. When the Minneapolis baseball team left for home, they boarded the train at San Antonio on Monday at 9 A.M. They arrived in Minneapolis on Wednesday at 10:45 A.M. How long did the trip home take? *(6)*

10. One of the Minneapolis players, who knocked a home run, ran around the four bases at the rate of 27′ a second. The distance from one base to the next was 90′. In making his run the player ran 20′ more than the shortest distance around the four bases. In how many seconds did he make the run? *(6)*

Go on to the next page.

11. Mrs. Roberts needs new linoleum for her kitchen floor. She can buy the kind that she likes for $2 per square yard. The dimensions of her kitchen floor are 12 ft. by 15 ft. How much should Mrs. Roberts expect to pay for enough of this linoleum for the floor? *(6)*

How to Find Your Score



Ruth Howard had the correct answers for Problems 1, 2, 3, 4, 6, 8, 9, and 10 in Problem Test 1.

The picture at the left shows how Ruth found her score. Look at Problem Test 1 again to see whether or not she put down the right number of points for each problem she worked correctly. Did Ruth find the correct sum?

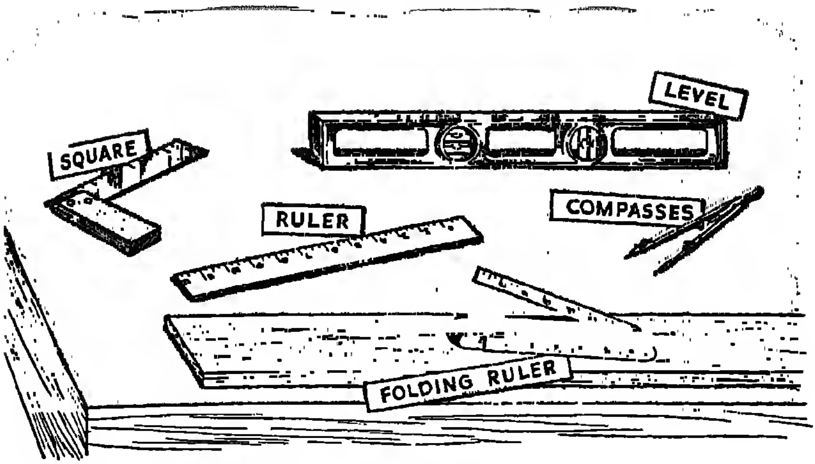
Look at the Standards below. Scores from 32 points to 44 points are *Good;* so Ruth's score was *Good.* Her friend Helen had a score of 50 points. Her score was __.

Standards for Problem Test 1

Poor	Fair	Average	Good	Excellent
0–6	7–14	15–31	32–44	45–56

After you know which problems you answered correctly in Problem Test 1, find the total number of points you have earned. Do it the same way Ruth did. How many points did you earn?

Look at the Standards. Was your work on this test *Excellent, Good, Average, Fair,* or *Poor?*



Estimating Distances

Ralph Myer's father earns his living by working as a carpenter. He uses the instruments shown above in measuring carefully to make sure that floors are level, walls are straight, and corners are square.

Sometimes you need to be able to measure approximately only, not so exactly as Mr. Myer does. And sometimes you need to have some idea of the measurements of an object, even though you have no measuring instrument at hand. In such cases you can *estimate* the measurements.

If you wanted to know the distance from your house to the store, you probably would not care to measure it with a yardstick. But you could estimate the distance, either by pacing it off—that is, by counting your steps—or by timing your trip to the store.

1. About how long a step do you take?

2. About how long does it take you to walk a mile?

You can also estimate lengths by seeing how long they look to you. This is called measuring "by eye."

3. Without measuring, draw a line one inch long. Then measure it. Was your line too long or too short?

4. Practice drawing lines 1 in. long, $1\frac{1}{2}$ in. long, 2 in. long, and so on, until you can come fairly close to the correct length each time.

5. Without measuring, place two objects one foot apart. Check this distance by measuring. Practice until you can judge distances of 1′, 2′, 3′, and so on.

6. Without measuring, mark off the following distances on your paper: $\frac{1}{2}$ in., $\frac{1}{4}$ in., $\frac{3}{4}$ in., $\frac{1}{8}$ in. Check the distances by measuring.

7. Why would it be foolish to estimate the length of a room as 21 ft. $7\frac{1}{2}$ in.? What would be a good estimate of the length of such a room?

8. Jim says he has a 10-minute walk to school. How can you tell about how far he lives from school?

9. Pace off 10 steps and measure the distance. Your "pace" averages how many inches?

10. How many steps would you take in pacing off a distance of 100 ft.?

11. Reach on the wall to a point as far as you can from the floor. Measure to find how far this point is from the floor. How can you use this fact in estimating distances?

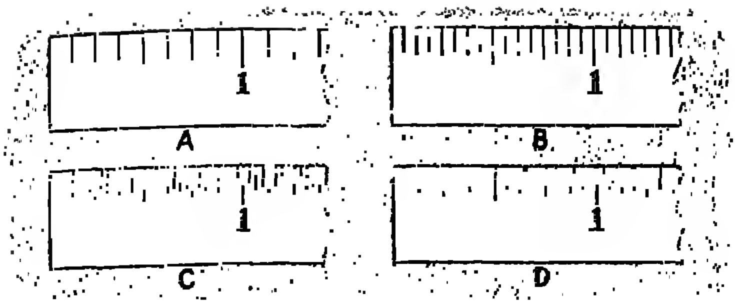
Estimate each distance below "by eye." Write down your estimate. Then measure each distance.

12. The length and width of your schoolroom

13. The height of your desk

14. The length of your pencil

15. The width and height of your schoolroom door



Measuring with Ruler and Compasses

Mr. Myer's rulers, or rules, are very useful instruments. Some of them are only 6 in. long, and others are 6 ft. long. Different fractions of an inch are marked on different rulers. The picture shows one end of each of four rulers.

1. Ruler A is marked in what fractions of an inch? This ruler is *graduated* in eighths of an inch. With Ruler A, Mr. Myer cannot measure more accurately than to the nearest eighth of an inch. Why would it be impossible for him to measure accurately to sixteenths of an inch with Ruler A? How could he estimate to sixteenths of an inch with this ruler?

2. Ruler B is graduated in what fractions of an inch? With this ruler you could estimate to what fraction of an inch?

3. How accurately could you measure with Ruler C?

4. If you wanted to measure accurately to sixty-fourths of an inch, which of the rulers would you use?

5. Could you measure accurately to eighths, sixteenths, and thirty-seconds of an inch with Ruler D?

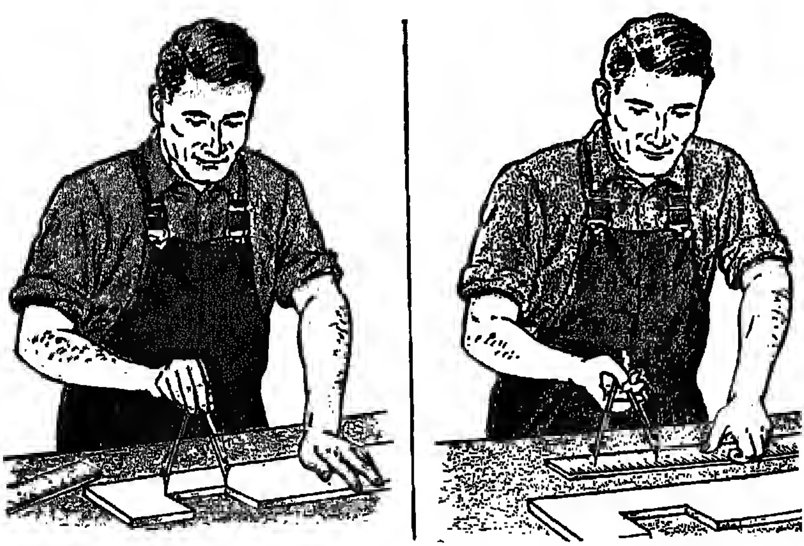
6. Would Ruler A be suitable to use to measure a board before sawing it? Why?

7. Mr. Myer often uses his pair of compasses to help him measure accurately. The pictures below show how he uses his compasses to measure a distance. He spreads the compasses so that one arm is at each end of the distance. Then he uses his ruler to find the distance between the points of the compasses. Why is this a very accurate way of measuring a distance?

8. Mr. Myer also uses the compasses in places where he cannot get a ruler in a position to measure. For example, he uses the compasses to measure a distance on the bottom of a box when the ruler is too long. Can you think of other places in which the compasses would make measurement easier or more accurate?

Another important use of the compasses is to measure off a distance equal to another distance, or to draw a line that is equal in length to another line.

The pictures at the top of the next page show how Mr. Myer marks off a part of a line to make it equal in length to another line on a board.

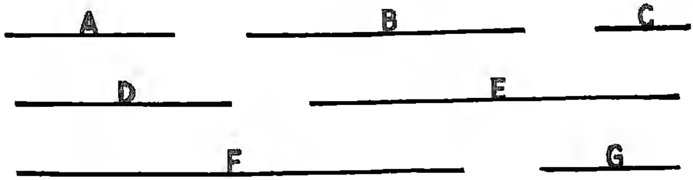


He spreads the compasses so that one arm is at each end of the line. Then he puts the compasses in position along the other line and marks across it, either with the point of the compasses or with a pencil.

9. Which is likely to be more accurate, to mark with the compasses or with a pencil? Why?

10. For each line below do the following: estimate its length; measure it with your compasses and ruler to see how accurate your estimate is; use compasses and ruler to draw a line of equal length on your paper.

11. How accurately would you measure to find the length of a curtain needed for a window? A pane of glass for a window? Explain your answers.



Problems on Estimating Distances

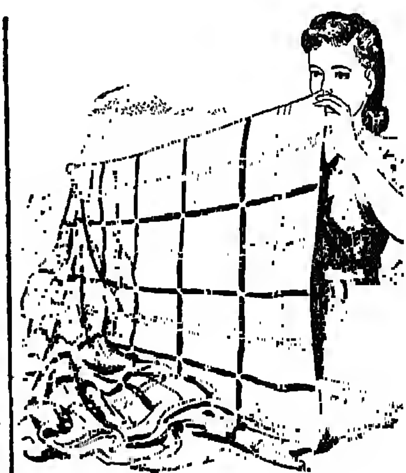
1. Dave Ward estimated the length of his desk by *spanning* the length with his outstretched hand, as shown below. When he did this, he spanned it $3\frac{1}{2}$ times. He knew that the distance from the end of his thumb to the end of his little finger with his hand spread out was about 7 in. About how long was his desk?

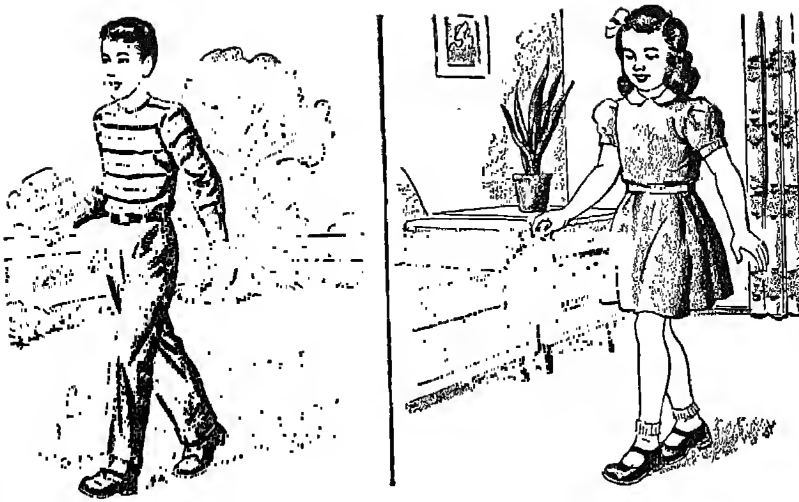
2. Mary Post's hand span was about 6 in. About how many times could she have spanned Dave's desk?

3. What is your approximate hand span? Estimate the width of your desk by spanning it with your hand.

4. The picture below shows how Mrs. Jones estimated the length of a piece of cloth by seeing how many times it reached from her nose to the end of her extended arm. For her this distance is 1 in. less than a yard. The piece of cloth she measured reached 5 times and about 8 in. more. It was about how many yards long?

5. If you were measuring cloth in this way, what length would you have to use instead of 35 in.?





6. The picture above shows how Helen's brother Bob found the approximate dimensions of a field by pacing off the length and width. He knew that his pace, or step, was 30 in. long. The field was 264 paces long and 176 paces wide. It was about how many feet long and how many feet wide?

7. Helen estimated the length of the living room in the way shown above. She knew that the length of her foot, with her shoe on, was about $7\frac{1}{2}$ in. She found that the length of the room was 30 shoe lengths. The room was about how many feet long?

8. Because the mileage recorder on Dr. Ryan's car was broken, he had to estimate the distance from his office to a patient's home. He drove as nearly as he could at a speed of 30 mi. per hour. The trip took him 15 min. About how far was the patient's home from his office?

9. Was Dr. Ryan's estimate likely to be different from the exact distance? Why?

Learning through Practice

1. Add:

.10	$\frac{7}{8}$	195	96.5	$4\frac{3}{5}$	25	$3\frac{1}{4}$
.56	$5\frac{3}{4}$	58	58.8	$7\frac{1}{6}$	586	$\frac{5}{8}$
.05	$\frac{7}{12}$	671	13.0	$6\frac{5}{6}$	63307	$16\frac{1}{2}$
.77		237	36.7		8096	

Subtract:

2.

1.708	$2\frac{3}{4}$	53700	14	$8\frac{11}{12}$	914.028	$12\frac{3}{4}$
.359	$\frac{1}{3}$	19589	$\frac{7}{8}$	$8\frac{7}{12}$	30.175	$8\frac{5}{6}$

Multiply:

3.

65	8.62	739	$74.10	5942	48.005
3.8	9	806	64	59	58

4. $\frac{3}{4}\times\frac{5}{6}$ $\quad 1\frac{1}{6}\times\frac{9}{10}$ $\quad 3\times7\frac{2}{3}$ $\quad \frac{3}{8}\times4\frac{2}{3}$ $\quad 4\frac{1}{8}\times6$

5. $8\overline{).534}$ $\quad 25\overline{)2.5}$ $\quad 72\overline{)810}$ $\quad 73\overline{)42}$

6. $\frac{3}{16}\div\frac{1}{2}$ $\quad \frac{7}{12}\div1\frac{1}{5}$ $\quad 8\frac{5}{12}\div1\frac{1}{8}$ $\quad 6\frac{5}{6}\div\frac{2}{5}$ $\quad \frac{1}{10}\div4$

Extra Practice for Those Who Need It

Multiply:

7.

4605	869	2.7	$50.09	86	3.4
.8	478	.007	32	53	3.5

8. $\frac{7}{8}\times15$ $\quad 8\times\frac{1}{3}$ $\quad \frac{9}{10}\times2\frac{11}{12}$ $\quad 2\frac{1}{10}\times\frac{5}{6}$

9. $8\overline{).04}$ $\quad 75\overline{)\$456}$ $\quad .27\overline{).546}$ $\quad 319\overline{)88044}$

10. $4\frac{5}{6}\div\frac{1}{5}$ $\quad 3\frac{1}{16}\div4$ $\quad \frac{3}{8}\div\frac{1}{6}$ $\quad \frac{5}{6}\div\frac{5}{8}$ $\quad 7\frac{1}{5}\div6$

11. $6\div3\frac{2}{3}$ $\quad 3\frac{3}{8}\div\frac{1}{6}$ $\quad \frac{3}{8}\div\frac{3}{16}$ $\quad \frac{1}{8}\div1\frac{1}{4}$ $\quad 4\div3\frac{1}{5}$

Problems for Good Thinkers

When you solve a problem, be sure to read it carefully. You may do these problems incorrectly if you read them carelessly.

1. In a bar graph that Fred was making, he used a bar 1 inch long to represent \$100. How long a bar should he have used for \$75? For \$150? For \$100.50?

2. Jane "stepped off" the length of her room to find how many shoe lengths the distance was. She found the length to be 21 shoe lengths. The shoes that she wore were 8 in. long. Is it correct to say that the length of the room was approximately $\frac{2}{3}$ of 21 ft.? Why?

3. Jane's room was 12 ft. wide. To find how many shoe-lengths wide it was, do you divide 12 by $\frac{2}{3}$, or do you multiply 12 by $\frac{2}{3}$? How do you know?

4. Nancy has 4 pieces of colored paper. Their dimensions are: 12″ x 24″, 15″ x 21″, 17″ x 19″, 18″ x 18″. To decide which piece is the largest, should you find the perimeters or the areas? Why?

5. The dimensions of four pieces of wrapping paper are: 9″ x 16″, 8″ x 18″, 6″ x 24″, 12″ x 12″. Is any piece larger than any of the other pieces?

6. How can you tell, by just looking at the dimensions, which of the following pieces of paper is largest: A, 7″ x 12″; B, 12″ x 18″; C, 12″ x 12″; D, 7″ x 10″?

7. Is it correct to say that the longer the perimeter of a rectangle is, the larger its area is?

8. Which is cheaper, a yard of cloth 1 yd. wide at \$1.50 a yard, or a yard of cloth $1\frac{1}{2}$ yd. wide at \$2.25 a yard?

Rounding Off Fractions

In the pictures on page 91, Harry showed John how rounding off fractions helped him figure in his head.

1. Read Pictures 1 and 2. Is $\frac{7}{16}$ approximately $\frac{1}{2}$? How do you know?

2. Look at Pictures 3 and 4. How did Harry get the fraction $\frac{15}{23}$? Why did he think $\frac{16}{24}$ instead of $\frac{15}{23}$?

3. Why do you think Harry used $\frac{16}{24}$ instead of $\frac{15}{20}$?

4. The fraction $\frac{5.25}{19.75}$ in Picture 5 looks very hard. Is Harry's change in Picture 6 reasonable? Why?

5. It is impossible to use a fraction like $\frac{93}{358}$ or $\frac{151}{183}$ when you are figuring in your head. Is it reasonable to round off $\frac{93}{358}$ to $\frac{1}{4}$ and $\frac{151}{183}$ to $\frac{5}{6}$? Why?

6. Also, it is much easier to think of $\frac{1}{4}$ of a number than to think of $\frac{93}{358}$ of the number. Why?

7. A man who had 147 sheep sold 89 of them. Is it better to say that he sold about $\frac{3}{5}$ of his sheep or $\frac{2}{3}$ of his sheep? Why?

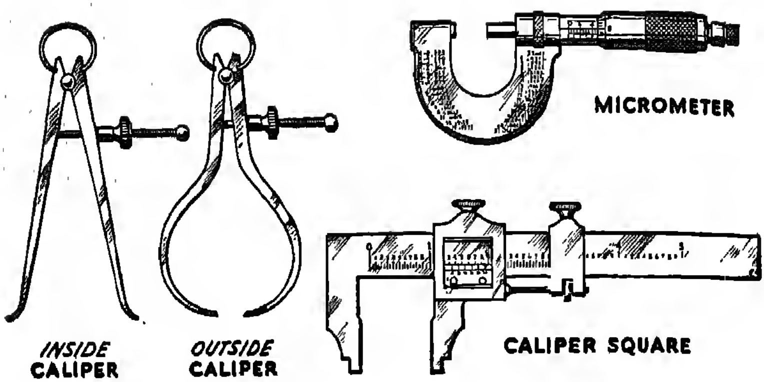
8. Tom decided to store 31 of his 189 books. About what fraction of his books did he decide to store?

9. One week Kay earned \$8.75. Her father earned \$44.75. The amount Kay earned that week was about what fraction of the amount her father earned?

When you divide in problems, you often get remainders like the fractions shown below. Copy each fraction and round it off to a useful approximate fraction.

10. $\frac{75}{316}$	$\frac{18}{92}$	$\frac{25}{37}$	$\frac{313}{580}$	$\frac{65}{87}$	$\frac{1120}{1573}$
11. $\frac{90}{111}$	$\frac{11}{84}$	$\frac{639}{987}$	$\frac{1486}{2103}$	$\frac{40}{131}$	$\frac{3811}{6009}$


I JUST GOT PAID FOR THE WORK I DID FOR MR. AUSTIN. I WORKED ABOUT 16 HOURS, AND HE PAID ME $7. THAT'S ABOUT HALF A DOLLAR AN HOUR.
I DON'T SEE HOW YOU FIGURE THAT. DIDN'T YOU EARN $\frac{7}{16}$ OF A DOLLAR PER HOUR?
YES, BUT $\frac{7}{16}$ IS A HARD FRACTION TO WORK IN MY HEAD. I ONLY WANTED AN APPROXIMATE ANSWER, ANYWAY.
OH, I SEE. YOU ROUNDED OFF THE FRACTION $\frac{7}{16}$ TO $\frac{1}{2}$ BECAUSE $\frac{7}{16}$ IS CLOSE ENOUGH TO $\frac{8}{16}$.
I OFTEN ROUND OFF FRACTIONS AND WHOLE NUMBERS WHEN I FIGURE OR ESTIMATE IN MY HEAD.
THAT'S A GOOD IDEA. HOW WOULD YOU FIGURE THIS ONE? THERE ARE 23 IN MY CLASS AT SCHOOL. LAST WEEK WE BOUGHT $15 WORTH OF SAVINGS STAMPS. THIS AMOUNTED TO ABOUT HOW MUCH APIECE?
$\frac{15}{23}$ IS CERTAINLY AN AWKWARD FRACTION. BUT IT IS ALMOST EQUAL TO $\frac{16}{24}$; SO YOU COULD SAY THAT THE AVERAGE AMOUNT PER PUPIL WAS ABOUT $\frac{2}{3}$ OF A DOLLAR.
WHEN I DIVIDE $15 BY 23, I GET A LITTLE OVER 65¢. $\frac{2}{3}$ OF A DOLLAR IS ABOUT 67¢. I THINK $\frac{2}{3}$ OF A DOLLAR IS A GOOD APPROXIMATE ANSWER.
SUPPOSE I EARNED $19.75 AND SPENT $5.25 OF THAT AMOUNT. WHAT FRACTION OF MY EARNINGS WOULD I HAVE SPENT?
I DON'T KNOW. IT'S HARD FOR ME TO FIGURE IN MY HEAD WHAT FRACTION EQUALS $\frac{5.25}{19.75}$.
IT'S REALLY EASY TO FIGURE AN APPROXIMATE FRACTION. $5.25 IS ABOUT $5, AND $19.75 IS ABOUT $20. NOW CAN YOU FIGURE THE FRACTION?
YES, OF COURSE. $\frac{5}{20}$ EQUALS $\frac{1}{4}$. SO YOU WOULD HAVE SPENT APPROXIMATELY $\frac{1}{4}$ OF YOUR EARNINGS.



Exact Measuring

Mr. Ames makes his living by using his knowledge of measurement. He is an inspector in a large plant that makes airplane motors. He must make sure that certain motor parts are exactly the right size.

In carpentry $\frac{1}{16}$ in. is an exact measurement, but to Mr. Ames an exact measurement may mean $\frac{1}{1000}$ in., $\frac{1}{10,000}$ in., or even $\frac{1}{100,000}$ in. If he should make a mistake of $\frac{1}{1000}$ in. in measuring, the parts would not fit, and the motor would not run smoothly.

Of course, Mr. Ames cannot use such measuring instruments as the ruler and compasses for these exact measurements. He must use instruments especially made for this kind of measuring. Instruments like these are graduated very finely.

Some of the instruments used for extremely exact measuring are shown in the picture above.

The first two are called *calipers*. One of them is used to take the outside measurements of wheels, pipes, shafts, and other machine parts.

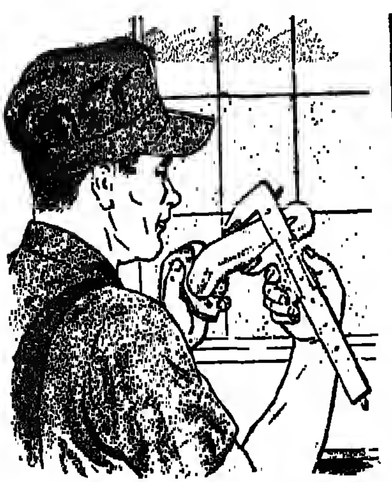
1. To take the outside measurement of a pipe, Mr. Ames fixes the points of the caliper so that the pipe just passes between them. Then he measures on a ruler the distance between the points. What determines how accurate the measurement is?

2. The other caliper in the picture on page 92 is used to take the inside measurements of pipes, the widths of holes, or the distances between objects. Name some objects that can be measured by inside calipers.

3. Look at the *caliper square* on page 92. The first picture below shows Mr. Ames using one. He is measuring accurately to .001 of an inch. Why is it more accurate than the outside caliper?

4. The other picture below shows Mr. Ames measuring a cylinder with a *micrometer* like the one in the picture on page 92. It can measure to .0001 of an inch. Why does he not use a ruler?

5. Mechanics and engineers use other instruments to measure exactly. Have you seen any of them? For what are they used? How accurately do they measure?



Standards of Measurement

If you bought a pound of candy in Ohio and later bought a pound of the same kind of candy in Maine, you would get the same amount both times. This is because the pound has been given a *standard* weight.

Standards for length and weight have been set by the United States Government. There is a standard inch, foot, yard, ounce, pound, gallon, and so on. A model of each standard is kept in Washington by the National Bureau of Standards. Copies of measures based on these standards have been furnished to each state.

The yardstick that you use is the same length as the one that your neighbor uses because both of them were made to agree closely with the model yard that is kept in Washington.

The yard is used for most measuring in this country, but the standard unit of length, by act of Congress, is the *meter*. According to the law, the yard is $\frac{3600}{3937}$ of a meter. A meter is equal to 39.37 inches.

Another standard unit that is often used in scientific work and in trading with other countries is a unit of weight called the *kilogram*. In this country the standard pound is based on the kilogram. The kilogram is equal to 35.274 oz., or about 2.2 lb.

Two different tons are used in this country. The one most often used is equal to 2000 lb. and is sometimes called the *short ton*. In some states certain things, such as iron and coal at the mine, are weighed in *long tons*. A long ton is equal to 2240 lb.

Is the long ton used in your state? If so, for what?

1. In most states a bushel of anything must be measured by weight. The weight per bushel of any article sold by the bushel is not alike in all the states. In Illinois 48 lb. of barley make a legal bushel of barley, but in California 50 lb. of barley equal one bushel. Try to find the reasons for these differences.

2. Try to find out how many pounds of each of the following are equal to a bushel in your state: shelled corn, rye, apples, white potatoes, onions.

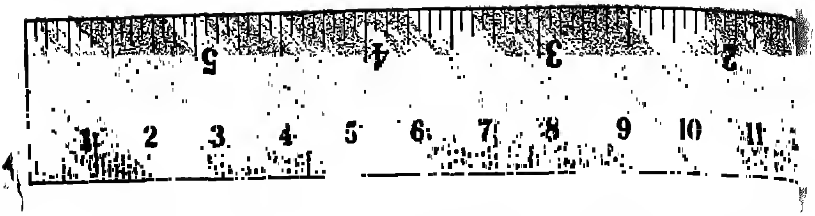
3. Why are merchants required by law in many states to sell such produce as potatoes, bananas, apples, and onions by weight instead of by the quart or peck?

4. What produce that is sold by the dozen is graded as to size? Why is it graded?

Metric Measures

The meter and the kilogram that you read about on page 94 belong to a system of measurement called the *metric system*. This system was developed many years ago by a committee of French scientists and got its name from the meter, which is the standard unit of length. The standard meter is a length marked on a metal bar that is kept near Paris, France. Two copies of this standard meter are in our National Bureau of Standards in Washington.

Metric measures are used in most countries of the world. In the United States they are used by doctors and scientists, in some sports, by the United States Mint, for radio wave lengths, and by the post office for weighing foreign mail. The metric system may be even more important as a result of the war. Why?



There are metric measures for measuring nearly everything except time. The metric measures that are important for you now are the meter, centimeter, millimeter, kilometer, liter, gram, and kilogram.

1. The ruler shown above is marked in inches and also in *centimeters*. A centimeter is a measure of length and is .01 of a meter. From what you already know about the meter, try to find out why a centimeter equals .3937 in. This is approximately $\frac{2}{5}$ in.

2. A line $2\frac{1}{2}$ centimeters long is almost equal to a line __ in. long. A line __ centimeters long is almost equal to a line 4 in. long.

3. On the ruler above, each centimeter is divided into 10 equal parts. Each of these parts is a *millimeter*. A millimeter is what fraction of a centimeter? How do you know that a millimeter is .001 of a meter?

4. 1 millimeter = .03937 in., or about $\frac{1}{25}$ in. Are 9 millimeters equal to about $\frac{1}{2}$ in., $\frac{1}{3}$ in., or $\frac{1}{4}$ in.?

5. Without measuring, mark a length that you think is 3 centimeters on the edge of a paper. Compare this length with 3 centimeters on the ruler above. Is the length you marked too long or too short?

6. Make a line that you think is 9 millimeters long. Measure your line along the ruler in the picture.

7. Practice marking different lengths on your paper until you can estimate lengths in centimeters and in millimeters with considerable accuracy.

8. In the metric system long distances are measured by the *kilometer*. A kilometer equals 1000 meters. It also equals 3280.8 ft., or approximately $\frac{5}{8}$ mi. About how many miles do 10 kilometers equal?

9. The metric unit for measuring liquids is the *liter*. The liter equals 1.06 qt. Is it correct to say that a liter is equal to about 1 quart and $\frac{1}{4}$ cupful?

10. The *gram*, which is the metric unit of weight, is often used in this country. Many hospitals record the weights of infants in grams. Medicines often are weighed in grams and parts of a gram. A gram is equal to .035 oz., or about $\frac{1}{30}$ oz. Why is the gram a convenient unit of weight in scientific work?

11. Heavier things are weighed in *kilograms* in the metric system. 1 kilogram is 1000 grams. It is equal to 2.2046 lb., or about $2\frac{1}{5}$ lb. Since a kilogram is more than a pound, would a weight of 100 lb. be more than, or less than, a weight of 100 kilograms?

The table below gives approximate values for the metric measures you have just studied. Use the facts in this table whenever you read about metric measures or work with them.

1 kilometer = 3281 ft., or $\frac{5}{8}$ mi.

1 meter = 39.37 in., or $3\frac{1}{4}$ ft., or 1 yd. $3\frac{3}{8}$ in.

1 centimeter = .4 in., or $\frac{2}{5}$ in.

1 millimeter = .04 in., or $\frac{1}{25}$ in.

1 liter = 1.06 qt., or 1 qt. $\frac{1}{4}$ cupful

1 kilogram = 2.2 lb., or $2\frac{1}{5}$ lb.

1 gram = .035 oz., or $\frac{1}{30}$ oz.

Problems about Measures

Many kinds of jobs have their own measures that are very important to the persons who work at the job. No one ever uses all these measures, but it is interesting to know something about them and to see how they are used in different kinds of work.

1. Printers, for example, use a measure called the *pica*, which is approximately $\frac{1}{6}$ of an inch. A line that is 8 in. long would be about how many picas long? Each pica is divided into 12 *points*. This letter x is about 6 points high. It is about what fraction of a pica high?

2. Farmers sometimes measure the height of a horse in *hands*. A horse that is 15 hands high is 60 in. from the ground to the top of its shoulder. A hand equals __ in.

3. When a sailor measures the depth of water, he uses the *fathom* as his unit of measure. A fathom is equal to 6 ft. At a certain spot in a lake the water is 72 ft. deep. It is how many fathoms deep?

4. Sailors also use a mile that is different from the mile we ordinarily use. It is called a *nautical mile* and is equal to about 6080 ft. A nautical mile is about how many feet longer than the mile we ordinarily use?

5. A nautical mile is about __ times a land mile.

6. At the mine, coal is weighed and sold by the long ton, which is 2240 lb. But when your father buys coal, he buys it by the short ton. How many pounds difference is there between 5 T. of coal at the mine and 5 T. of coal at the coal yard?

7. Men's hats are made over wooden blocks that are called "ovals." To find the size of a hat made over a certain oval, you add the length and width of the oval and then divide by 2. The length of a certain oval is $7\frac{13}{16}$ in., and its width is $6\frac{7}{16}$ in. Find what size hat is made on this oval.

8. The next larger size is made on an oval that is $\frac{1}{8}$ in. longer and wider than the oval mentioned in Problem 7. How long and how wide is this larger oval? What size hat is made on it?

9. Men who make guns have to know what is meant by a 32-caliber rifle and by an 88-millimeter field gun. If you do not already know, try to find out what these special measures mean.

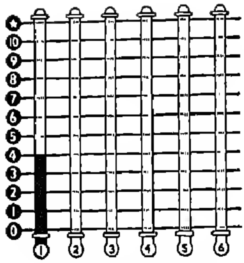
Think before You Answer

1. Mr. Hood's farm is 1 sq. mi. in area. He says he needs 4 miles of fence to surround his farm. Can this be true? Draw a diagram to prove your answer.

2. Mr. Lake's farm is also 1 sq. mi. in area. But he says that he needs $8\frac{1}{2}$ miles of fence to surround his farm. Can this be true? Draw a diagram to prove your answer.

3. Is it harder to estimate 10 feet or 100 feet by just looking at the distance? Why?

4. Ann measured the distance from the edge of a table to the floor with a yardstick. She found it was 26 in. Dorothy measured with the same yardstick and found it was 27 in. What may have caused the difference in their measurements?



Self-Testing Drill 2

You will have exactly *20 minutes* for this drill. If you finish before the time is up, try "A Side-Trip in Mathematics" on the next page.

1. $\frac{2}{3} \div \frac{1}{4} =$

2. Subtract:
1067298
476239

3. Subtract:
10804852
6128467

4. $39\overline{)27612}$

5. Subtract:
9566.27
5092.68

6. $3\frac{1}{3} \times 12 =$

7. $\frac{4}{5} + \frac{2}{3} + \frac{1}{6} =$

8. Divide 7 qt. 1 pt. by 5.

9. Subtract:
$21\frac{1}{4}$
$17\frac{3}{4}$

10. Multiply:
216
578

11. Subtract:
8 qt.
2 qt. 1 pt.

12. Find the average:
5084
491
6572
5976
9489

13.
.7399
.0865
.0988
.9597
.0769
.3496

14. Multiply:
59.6
3.9

15. $3\frac{7}{12} \times 2\frac{2}{3} =$

16. What is the difference between $56\frac{1}{12}$ and $17\frac{1}{4}$?

17.
$3\frac{2}{5}$
6
$4\frac{1}{3}$
$2\frac{1}{6}$

18. Find the answer to two decimal places:
$3.69\overline{)18.794}$

19. Change to simplest form: (*a*) 3 ft. 14 in. (*b*) 3 yd. 22 ft. (*c*) 1 yd. 76 in.

20. Is 500, 450, or 400 the best approximate answer for $162328 \div 394$?

Example 19 is wrong if any part is wrong.

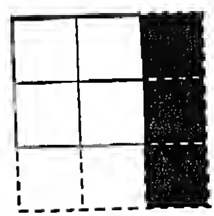
Use the Standards below to find your rating as you did for Drill 1. Then mark your Progress Chart.

Standards for Self-Testing Drill 2

Number Correct	0	1–4	5–6	7	8	9	10	11	12–13	14–15	16–19	20
Rating	0	1	2	3	4	5	6	7	8	9	10	★

A Side-Trip in Mathematics

In your mathematics work you will often need to multiply a number by itself. This is called "squaring" the number. You may write 2×2 as 2^2; 3×3 as 3^2; 4×4 as 4^2; and so on. Read 2^2 as *2 square*. Read each of the following numbers: 3^2, 4^2, 11^2, 100^2.



What part of the diagram at the right shows that $2^2=4$? To show what 3^2 equals, just add 2 small squares on one side and 3 on the other. Why?

$3^2=2^2+2+3=4+2+3=9$.

1. On a diagram show that $4^2=16$. Then show on your diagram that $5^2=16+4+5=25$.

2. $12^2=144$. $13^2=144+\_+\_=\_$.

3. $10^2=\_$. How can you find the square of 11?

4. Make a table of the squares of the numbers from 1 to 20.

5. If you know what 17^2 is, why is it easy to figure 17×18 in your head?

Without Pencil

	A	B	C	D	E	F
1.	Multiply: 96 × 9	Find the average: 17, 5, 4.	$\frac{3}{16}+\frac{9}{16}$	Is 1 kilogram more or less than 1 lb.?	$\frac{4}{5}\times\frac{5}{16}$	1.1 − .7
2.	.036 ÷ 6	Subtract: 378 − 199	$89\overline{)269}$	$\frac{1}{3}\div 4$	69 + 42 + 9 + 12	Multiply: 2 ft. 7 in. × 3
3.	$14-\frac{3}{8}$	1 in. = about ___ centimeters	Subtract: $1\frac{5}{8}-\frac{3}{4}$	.016 × 100	12 ÷ 1000	$\frac{227}{319}$ = what approximate fraction?
4.	2 long tons = __ pounds	To the nearest whole number $10\frac{17}{19}$ equals ____.	Subtract: 3 yd. 1 ft. − 1 yd. 2 ft.	$5\frac{12}{4}$ in simplest form is _____.	.0002 is read 2 ____.	$76\overline{)22.8}$

Learning through Practice

	A	B	C	D
1.	12.42 − 8.63	75 × 843	967 + 458	$\frac{9}{10}\times\frac{7}{12}$
2.	31709 ÷ 37	18.99 ÷ .35	$25\frac{1}{4}+2\frac{4}{5}$	$\frac{5}{12}\div\frac{2}{5}$
3.	.506 × 32.5	$27\frac{1}{8}\times 616$	$7006\frac{1}{3}+82\frac{1}{4}$	$8\frac{5}{6}-5\frac{2}{5}$
4.	$795\frac{3}{8}-60\frac{5}{8}$	48096 ÷ 48	$\frac{3}{10}\times 2\frac{2}{3}$	$2\frac{3}{4}\div\frac{1}{8}$
5.	93.80 + 46.85	$8\frac{1}{2}\div 2\frac{1}{8}$	.04 × .1975	$8\frac{5}{6}-7\frac{1}{4}$

Extra Practice for Those Who Need It

	A	B	C	D
6.	87 + 45 + 17	.5504 ÷ .43	.141 − .053	$70\frac{3}{8}-\frac{5}{8}$
7.	$6\frac{5}{6}\times 2684$	8001 − 917	$15\frac{1}{12}+19\frac{7}{12}$	$\frac{3}{4}\div 2\frac{1}{16}$
8.	38.9 ÷ 5.19	$90\frac{3}{5}\times 1045$	$15\frac{3}{4}-7\frac{3}{10}$	$9\frac{3}{5}+1\frac{9}{10}$
9.	280 × 974	18902 ÷ 94	$421\frac{7}{8}+46\frac{3}{8}$	$7\frac{3}{4}\div 1\frac{2}{3}$

Understanding Decimals

Everyone uses fractions. Workers who measure very exactly often use small fractions, such as hundred-thousandths and millionths. In everyday life common fractions are used more than decimals, but in many kinds of work decimals are used almost entirely.

If you understand decimals, they are easier to work with than common fractions. Decimals seem hard to understand because the denominators of these fractions are not written. The number of places in a decimal fraction tells you what the denominator is.

1. How many decimal places are in .3? The denominator of .3 is really 10. You read .3 as *three tenths.*

2. There are __ decimal places in .03. The denominator is really __. How do you read .03?

3. How many decimal places does .003 have? What is its denominator? .003 is read as __.

4. There are __ decimal places in .0003. What is its denominator? Read .0003 as __.

5. $\frac{3}{100000}$ can be written as the decimal .00003. How many decimal places are there? What is the denominator? Read .00003 as *three hundred-thousandths.*

6. $\frac{23761}{100000}$ can be written with __ decimal places as .23761. What is the denominator? Read .23761 as *twenty-three thousand seven hundred sixty-one* __.

7. $\frac{3}{1000000}$ can be written with 6 decimal places as .000003. The denominator of .000003 is __. Read .000003 as *three millionths.*

8. $\frac{594836}{1000000}$ can be written as the decimal .594836. How do you read this decimal?

To read any decimal fraction, first read the part after the decimal point just as you read any whole number. Then the number of decimal places will tell you if the denominator should be tenths, hundredths, thousandths, ten-thousandths, hundred-thousandths, or millionths. You will seldom need to use decimals as small as millionths. Just remember there is no end to the number of places a decimal fraction may have.

9. Read the following decimals.

.76 3.514 .00631 .548769 2.9 .05

10. Any common fraction can be changed to a decimal. To change $\frac{24}{25}$ to a decimal, divide 24 by 25. Does $\frac{24}{25}$ equal .96? To change $\frac{1}{4}$ to a decimal, divide 1 by __. $\frac{1}{4}=.$__. How do you change $\frac{4}{5}$ to a decimal? $\frac{4}{5}=.$__.

11. If the denominator of the fraction you are changing is 10, 100, 1000, 10,000, 100,000, or 1,000,000, it is easy to change the fraction to a decimal. For example, to write $\frac{3}{10}$ as a decimal, divide 3 by 10. You can think of 3 as having a decimal point at the right of it. To divide 3 by 10, just move the decimal point one place to the left. $3 \div 10 = .3$. Does $\frac{3}{10}$ equal .3?

12. To change $\frac{79}{100}$ to a decimal, move the decimal point two places to the left. $\frac{79}{100}=.$__.

13. How would you move the decimal point to change $\frac{311}{10000}$ to a decimal? $\frac{311}{10000}=.0311$. Why is the 0 put in front of the 3?

14. Change the following fractions to decimals by moving the decimal point.

$\frac{17}{100}$ $\frac{209}{100000}$ $\frac{9}{10}$ $\frac{97285}{100000}$ $\frac{11}{1000000}$ $\frac{13}{1000}$

15. Can you change $\frac{24}{25}$ to a decimal by moving the decimal point? Why?

When you change a common fraction to a decimal fraction, round off the decimal to the nearest tenth, the nearest hundredth, the nearest thousandth, and so on, depending on how accurate your answer should be.

16. Change the following common fractions to decimals. Round off to the nearest thousandth any that does not come out exactly at one or two decimal places.

$\frac{13}{25}$ $\frac{7}{1000}$ $\frac{5}{16}$ $\frac{921}{10000}$ $\frac{7}{8}$ $\frac{6}{7}$ $\frac{178259}{1000000}$ $\frac{1}{64}$

Decimals are easy to work with because you do not have to change them before you can compare them or add them or subtract them. For example, you can add .67, .589, and .23568 without changing the decimals at all. You just write the decimals in a column, keeping the decimal points in a straight line, and add. You can do this because .67 = .67000 and .589 = .58900.

When you add or subtract common fractions, you often have to do some figuring to make their denominators alike.

17. Look at the common fractions at the right. To add them, you must change each of the first five to millionths so that all six will have the same denominator.

18. Now look at the decimal fractions. You add them just as you add any column of numbers, without changing them.

$$\frac{5}{10} = .5$$

$$\frac{5}{100} = .05$$

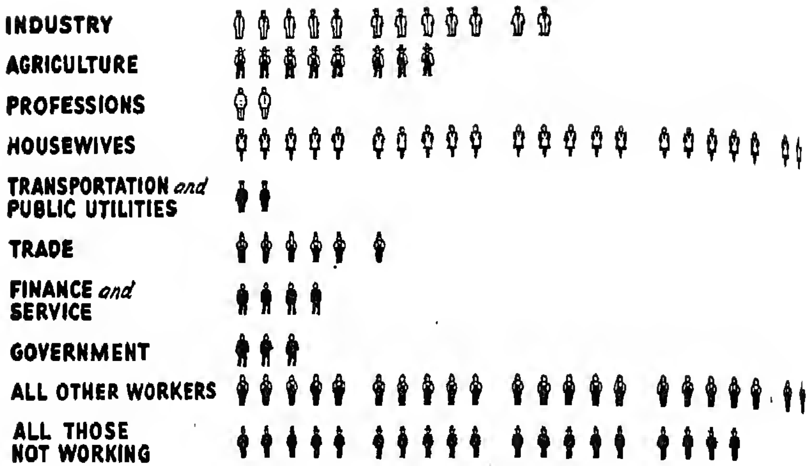
$$\frac{5}{1000} = .005$$

$$\frac{5}{10000} = .0005$$

$$\frac{5}{100000} = .00005$$

$$\frac{5}{1000000} = .000005$$

$$\frac{555555}{1000000} = .555555$$



The Meaning of Per Cent

The Holton *Leader* published the graph shown above. The graph shows how many persons out of each 100 of Holton's population were working at different jobs and how many were not working.

Each picture on the graph means one person out of 100. Out of each 100 persons, how many had jobs in industry? Why can you say that .12 had jobs in industry?

There is another way to state this fact. You can say that 12 *per cent* had jobs in industry. Per cent means *by the hundred,* or *hundredths.* A short way to write 12 per cent is shown at the right. The sign after the 12 means *per cent.*

12%

1. How many persons out of each 100 worked in agriculture? $\frac{8}{100}$, or .08, or 8% worked in agriculture.

2. __ persons out of each 100 did professional work. How do you know that 2% did professional work?

3. What per cent were housewives? What per cent did government work? What per cent were not working?

4. There are 100 dots in Circle A below. Each fifth of the circle has __ dots, or __% of all the dots.

5. In $\frac{2}{5}$ of the circle there are __ dots. __% of all the dots are in $\frac{2}{5}$ of the circle.

6. What per cent of all the dots are in $\frac{3}{5}$ of the circle? In $\frac{4}{5}$ of the circle?

7. There are 100 small squares in Square B. How many of the small squares are black? __% of the small squares are black.

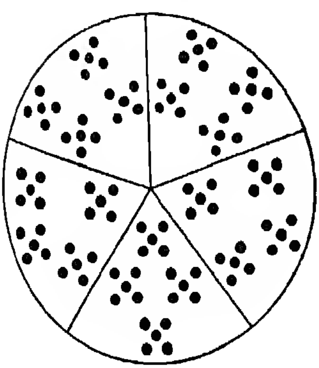
8. What per cent of the small squares are white?

9. Draw a $2\frac{1}{2}''$ square. Divide it into 100 small squares by drawing lines $\frac{1}{4}$ in. apart. Make a design, using 36% of the small squares.

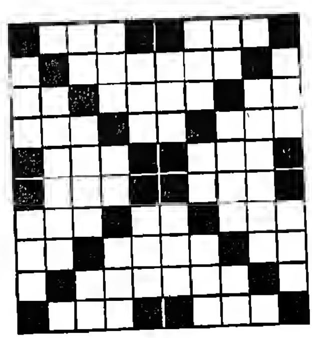
10. Draw another $2\frac{1}{2}''$ square and divide it into 100 small squares. Put a dot in 31% of the squares.

11. Show 19% on the last drawing you made by putting an X in the correct number of squares.

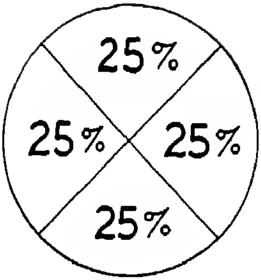
12. There are 100 pupils in Grades 7 and 8 at the Austin School. 43 pupils are in Grade 7, and the others are in Grade 8. What per cent of the pupils in these two grades are in Grade 8?

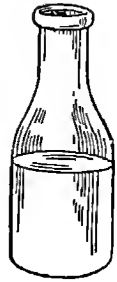


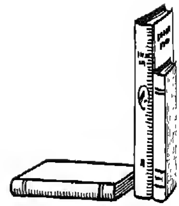
A



B







What 100% Means

The circle above is marked off into 4 equal parts. Each part is $\frac{1}{4}$, or .25, or 25% of the whole circle. The sum of $\frac{1}{4}$, $\frac{1}{4}$, $\frac{1}{4}$, and $\frac{1}{4}$ is __, or the whole circle. What is the sum of .25, .25, .25, and .25? Now add 25%, 25%, 25%, and 25%. What is this sum? 100% of the circle is the whole circle.

100% of \$2 = \$2. 100% of 30 men = 30 men. 100% of 1 T. = 1 T.

$100\% = \frac{100}{100} = 1.00 = 1$, or all of something.

1. What is 100% of \$.08? 100% of 50 marbles = __ marbles. 100% of 42 pupils = __ pupils.

2. 10 dimes are shown above. If you had 100% of these 10 dimes, would you have a dollar? Why?

3. Since 100% of anything equals all of it, then 50% of anything equals $\frac{1}{2}$ of it. Why?

4. Why is 25% of a pie the same as $\frac{1}{4}$ of a pie?

5. Why is 75% of \$1 the same as $\frac{3}{4}$ of \$1?

6. A pint of milk has been poured from the quart bottle above. The milk that is left is 50% of the milk that was in the bottle when it was full. Why?

7. The 3 books shown above are 25% of all of Roberta's books. How many books does she have?

8. A yard of ribbon was cut into equal pieces. Look at Picture A below. Does the picture show 100% of the yard of ribbon? Explain your answer.

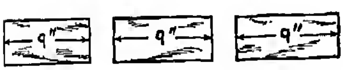
9. Picture B shows that May drank 1 pt. and 1 cup of milk one day. Did she drink 25% of a quart, 50% of a quart, or 75% of a quart? Why do you think so?

10. The gallon container shown in Picture C has __ gal. of water in it. Should you add 25% of a gallon, 50% of a gallon, or 75% of a gallon to fill the container? Why?

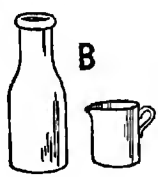
11. Mr. Gray spends 10 hr. a day away from home in doing his work. This time is divided as shown in Picture D. What per cent of the 10 hr. does he spend in traveling? In eating lunch? In actual work?

12. What per cent of Square E is missing?

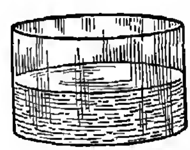
13. Four parts of a circle are shown in Picture F. Could you put these together to form a whole circle? Why or why not?



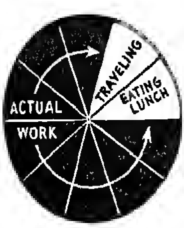
A



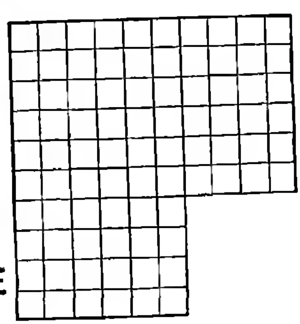
B



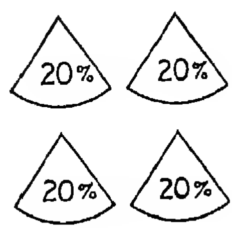
C



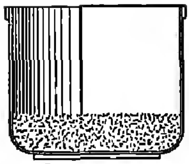
D

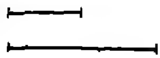


E



F



Line A 

Line B

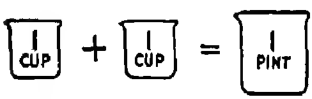
14. There is 1 peck of wheat in the basket shown at the left. The basket is 25% full. How much does the basket hold when it is full?

15. Line A at the left is 1 centimeter long. It is 50% as long as Line B. How long is Line B?

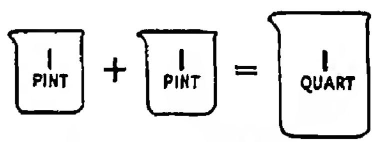
16. Mrs. Shane went to two stores to buy some butter. She bought 25% of a pound in one store and 25% of a pound in another. Did she buy a whole pound in both stores? How do you know?

17. Mr. Hood spends 50 min. each day in traveling to and from work. Mr. Owen spends $\frac{1}{2}$ as much time traveling as Mr. Hood does. Mr. Owen's traveling time is __% of Mr. Hood's traveling time.

18. What numbers belong on the blank lines below?



__% + __% = __%



__% + __% = __%

19. There are 100 centimeters in one meter. One centimeter is __% of a meter.

20. There are 10 millimeters in one centimeter. One millimeter is __% of a centimeter.

21. One centimeter = about $\frac{2}{5}$ in. = about $\frac{?}{10}$ in. = about $\frac{?}{100}$ in. = about __% of an inch.

22. One millimeter = about $\frac{1}{25}$ in. = about $\frac{?}{100}$ in. = about __% of an inch.

Changing Decimals and Per Cents

It is not hard to change a decimal to a per cent when the decimal is in hundredths. For example, .17 may be written 17%. Notice that $.17 = \frac{17}{100}$, and $\frac{17}{100} = 17\%$.

1. How do you know that .02 may be written as 2%? May .47 be written as 47%? Why?

2. To change a decimal like .3 to a per cent, think: ".3 = .30, and .30 = 30%." Why do you change .3 to .30? How do you make this change?

3. To change .7 to a per cent, think: ".7 = .__, and .70 = __%."

4. Now change the following decimals to per cents.

.66 .01 .2 .09 .9 .12 .4

5. You will often need to change per cents to decimals. This is easy to do if you remember always that per cent means hundredths. For example, 13% means $\frac{13}{100}$; so 13% may be written as .13. 2% means __ hundredths. Why is $\frac{2}{100}$ written as .02, not as .2?

6. How do you know that 7% may be written as the decimal .07?

7. Change the following per cents to decimals.

22% 3% 9% 11% 84% 99% 1%

What numbers belong where the question marks and blank lines are below?

8. $2\% = \frac{2}{?} = .02$
9. $\_\% = \frac{99}{100} = .99$
10. $\_\% = \frac{?}{100} = .05$
11. $75\% = \frac{75}{?} = .\_$
12. $\_\% = \frac{18}{100} = .\_$
13. $5\% = \frac{?}{?} = .\_$
14. $\_\% = \frac{?}{?} = .52$
15. $\_\% = \frac{8}{100} = .\_$

Equal Fractions, Decimals, and Per Cents

Suppose you heard someone say, "I spent 50% of that \$5 I earned." Could you tell how much had been spent? Since 50% of anything equals $\frac{1}{2}$ of it, you know that $\frac{1}{2}$ of \$5, or \$__, was the amount spent. You can figure this in your head.

You can save yourself time and trouble in your work with per cents if you know the common fractions and decimal fractions that are equal to certain per cents.

The table at the right below gives important fractions, decimals, and per cents that are equal.

$\frac{1}{2}$	= .5	= 50%
$\frac{1}{4}$	= .25	= 25%
$\frac{3}{4}$	= .75	= 75%
$\frac{1}{5}$	= .2	= 20%
$\frac{2}{5}$	= .4	= 40%
$\frac{3}{5}$	= .6	= 60%
$\frac{4}{5}$	= .8	= 80%
$\frac{1}{10}$	= .1	= 10%
$\frac{3}{10}$	= .3	= 30%
$\frac{7}{10}$	= .7	= 70%
$\frac{9}{10}$	= .9	= 90%

1. What decimal fraction equals $\frac{2}{5}$? What per cent equals $\frac{2}{5}$?

2. $\frac{1}{10}$ equals what decimal fraction? $\frac{1}{10}$ equals what per cent?

3. What per cent equals .7? What common fraction also equals .7?

4. What common fraction and what decimal fraction are equal to 40%?

5. 75% equals what decimal fraction? It equals what common fraction?

6. Learn all the facts in the table at the right. You will find that they will help you do your work faster and more accurately because you will not have to stop to figure out such things as $75\% = \frac{3}{4}$, or $\frac{1}{5} = 20\%$, or $\frac{3}{5} = .6$.

Comparing Fractions, Decimals, and Per Cents

Frank and Dorothy both earned the same amount one week. Frank spent 75% of his earnings that week for games. Dorothy spent $\frac{3}{5}$ of her week's earnings for games. Who spent more for games, Frank or Dorothy? You do not need to know how much each child earned before you can answer the question. Why?

You may be able to compare $\frac{3}{5}$ and 75% without much figuring. But if you cannot see right away which is the larger, you may change either $\frac{3}{5}$ or 75% so that both of them are common fractions, decimals, or per cents.

You can change 75% to a common fraction, or you can change both $\frac{3}{5}$ and 75% to a decimal fraction, or you can change $\frac{3}{5}$ to a per cent.

$$\frac{3}{5} = .6 = 60\%$$

$$\frac{3}{4} = .75 = 75\%$$

Here are three ways to get ready to compare $\frac{3}{5}$ and 75%:

A. Change 75% to a common fraction. 75% = __. What must you do before you can compare this fraction with $\frac{3}{5}$?

B. Change 75% and $\frac{3}{5}$ to decimals. 75% = .__. $\frac{3}{5}$ = .__. Can you compare the two decimals? Why?

C. Change $\frac{3}{5}$ to a per cent. $\frac{3}{5}$ = __%. Can you compare the two per cents? Why?

Which way seems easiest and most convenient?

1. Mr. Macy and Mr. Ellis are painters. Mr. Macy said that he could paint 50% of a wall in an hour. Mr. Ellis said that he could paint .4 of it in an hour. Which man thought he could paint the wall faster?

2. Is $\frac{1}{8}$ of a man's salary more than or less than 10% of his salary?

3. Ruth West earned \$20 per week. She received an increase of $\frac{3}{20}$ of her weekly pay. Ann Drew, who also earned \$20 per week, received a 15% increase. Which girl had the larger weekly pay then?

4. Joe made the following plan for using all the money he earned one month: for books, $\frac{1}{2}$; for skates, 15%; for clothes, $\frac{1}{4}$; for savings, _%. What per cent should Joe use for savings?

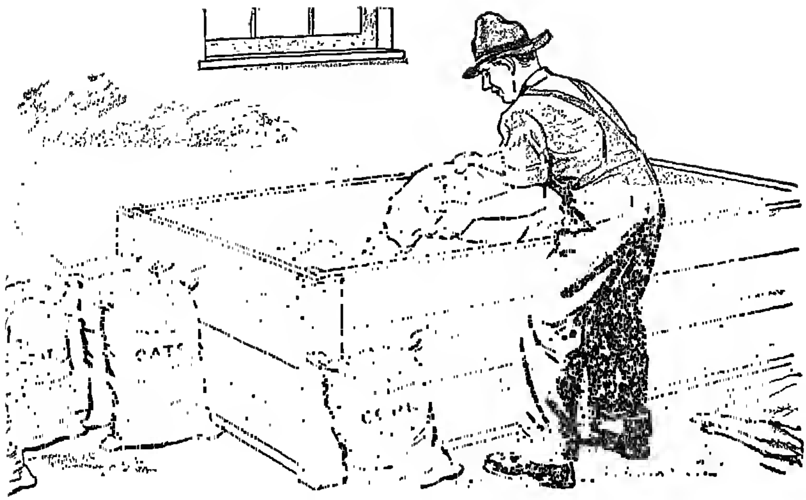
5. Why would it be impossible to spend a day as follows: 30% of the day working, 40% sleeping, 35% playing, and 10% eating?

6. A man said that 80% of his income came from his salary and the balance from investments. What per cent of his income came from investments?

7. In 1943 about 40% of all the butter made in the United States was made in the three states of Minnesota, Iowa, and Wisconsin. Is it correct to say that about $\frac{3}{5}$ of all the butter made in this country in 1943 was made outside these three states? Why?

8. John read this statement in a bulletin: "Alabama peach production in 1945 is expected to be one-fifth less than average but 50 per cent larger than the extremely small crop of last year." Was the 1944 crop more than or less than 20% below average?

9. John also read this statement in the bulletin: "In Oregon the May 1 condition of sweet cherries is 80 per cent, compared with 88 per cent a year ago." Was the May 1 condition of the cherries better or poorer than their condition a year ago?



Finding a Per Cent of a Number

Mr. Cook, who raises poultry, needs 1200 lb. of poultry feed. Since he plans to mix the feed himself, he must figure how much ground grain to buy. He knows that 62% of the feed should be corn. How much corn will he need for 1200 lb. of feed?

The work in Example A shows how to find the answer.

A
62% of 1200 lb. =
.62 of 1200 lb. =
.62 × 1200 lb. =
744.00 lb.

62% of 1200 lb. means the same as .62 of 1200 lb. Why?

.62 *of* 1200 lb. means .62 *times* 1200 lb.

.62×1200 lb. = 744.00 lb. Why do you point off the two decimal places in the answer?

How many pounds of corn will Mr. Cook need for the poultry feed?

1. 14% of the poultry feed should be wheat. How much wheat will Mr. Cook need? Example B at the top of the next page shows how to find 14% of 1200 lb.

B
14% of 1200 lb.=
.14 of 1200 lb.=
.14 × 1200 lb.=
168.00 lb.

Why is 14% changed to .14 in Example B? Is this change correct? Why is 1200 lb. multiplied by .14?

How is the 168 lb. found? Is it correct?

__ lb. of wheat will be needed.

Solve Problems 2, 3, and 4 below. Then look at Self-Help Examples C, D, and E at the bottom of this page to see if your work is correct.

2. Mr. Cook knows that 8% of the feed should be oats. How many pounds of oats will he need?

Why do you multiply 1200 lb. by .08?

3. 2% of the feed should be barley. Mr. Cook will need __ lb. of barley.

Why do you use .02 as your multiplier?

4. 9% of the feed should be bran. How many pounds of bran will be needed?

5. Mr. Cook has to have some tankage to mix in with the feed. 5% of the feed is to be tankage. How many pounds of tankage will he need?

6. Now add 62%, 14%, 8%, 2%, 9%, and 5%. How does the sum of these per cents tell you if everything that should go into the poultry feed has been included?

C	D	E
8% of 1200 lb.=	2% of 1200 lb.=	9% of 1200 lb.=
.08 × 1200 lb.=	.02 × 1200 lb.=	.09 × 1200 lb.=
96 lb.	24 lb.	108 lb.

7. Add 744 lb., 168 lb., 96 lb., 24 lb., 108 lb., and the answer you got for Problem 5. How do you know that your sum should be 1200 lb.?

8. Mr. Preston's salary was $47.50 per week. 10% of this amount was set aside to buy victory bonds. How much was set aside each week to buy these bonds?

9. The weight of cheese is about 10% of the weight of the milk from which it is made. About how many pounds of cheese can be made from 250 lb. of milk?

10. Prunes weigh only about 40% of the weight of the plums from which they are made. About how many pounds of prunes can be made from 1 T. of plums?

11. A statement in a newspaper said that housewives waste 15% of all the food they buy. If this is true, how many pounds of food would be wasted out of 1300 lb. of food bought for one family?

12. One year in California the lemon crop amounted to nearly 15,000,000 boxes. The next year the crop was about 86% of this. About how many boxes of lemons were produced in California the second year?

13. 33,000 T. of cherries were grown in California in 1942. It was expected that the 1944 cherry crop would be about 88% of this. The 1944 cherry crop was expected to be about __ T.

Now find the answers for the examples below.

14. 75% of 690	16. 8% of 305	18. 12% of 835
15. 20% of 98	17. 16% of 75	19. 30% of 420

20. In the problems and examples you worked above, you found a per cent of a number. How do you find a per cent of a number?

Commission as a Kind of Income

Philip Brent's father is an auctioneer. When the Harding family moved away from their farm, Mr. Brent sold their livestock and implements for a total of $4320. Mr. Brent received 8% of the total amount of the sale for his services as auctioneer.

The pay that Mr. Brent receives is a part of the money that is paid for the things he sells. This kind of pay is called *commission*. His *rate of commission* was 8%. To find how much commission he earned, find 8% of $4320, as in Example A at the right.

A

8 % of $4320 =
.08 × $4320 =
$345.60

Why do you multiply $4320 by .08?

Why do you point off two decimal places in the answer?

How much was Mr. Brent's commission?

1. At an 8% commission, find how much Mr. Brent would receive for sales amounting to $1726.

Example B shows how to find 8% of \$1726. Why do you use .08?

Now multiply \$1726 by .08. Is \$138.08 correct?

B
8% of \$1726 =
.08 × \$1726 =
\$138.08

Solve Problems 2, 3, and 4 below. Then compare your work with Self-Help Examples C, D, and E at the bottom of the page. Correct any mistakes you may have made.

2. Mr. Shawton is a salesman in the men's clothing department of a large store. He is paid a commission of 5% on all his sales. How much commission did he earn one week when his sales totaled \$850?

Why do you multiply by .05 in Problem 2?

3. Marcia Henderson takes subscriptions for a children's magazine that costs \$3 per year. She keeps a commission of 25% on each subscription. She should keep \$__ on each subscription.

What multiplier do you use in Problem 3? Will $\frac{1}{4}$ of \$3 also give you the answer? Why?

4. Marcia also takes subscriptions for a magazine that costs \$4 per year. She keeps a 20% commission on each subscription. How much should she keep on each of these subscriptions?

C	D	E
5% of \$850 =	25% of \$3 =	20% of \$4 =
.05 × \$850 =	.25 × \$3 =	.20 × \$4 =
\$42.50	\$.75	\$.80

5. Elizabeth Butler works in a large department store. She is paid \$20 per week plus a commission of 2% on the total amount of her sales. One week her total sales were \$642. Find the amount of her commission that week.

6. Miss Butler's salary and commission amounted to a total of \$__ that week.

7. A salesman for a baking company is paid a salary of \$55 per week plus a 5% commission on his total weekly sales over \$400. Last week his sales amounted to \$482. To find his commission, should you find 5% of \$482 or 5% of \$82? Why?

8. How much commission did he earn last week? How much did he earn altogether?

Think before You Answer

1. What are some advantages of working for a commission? What are some disadvantages?

2. Is the following statement correct? The occupations in which commission is paid are those in which something is sold or in which money is collected.

3. Name as many occupations as you can in which the workers might be paid commissions.

4. Why could not teachers be paid commissions instead of salaries?

5. Name five occupations in which commissions cannot be paid.

6. Does a commission of 14% mean that 14¢ out of each dollar collected will be paid to the salesman?

Practice with Per Cents

1. Write each of the following as a decimal.

20% 56% 4% 98% 1% 70% 9% 45%

2. Write each of the following as a common fraction with 100 as its denominator.

23% 6% 85% 10% 5% 65% 11% 43%

3. Write each of the following as a per cent.

.78 .09 .33 .50 .91 .57 .02 .25

4. Write each of the following as a per cent.

$\frac{1}{10}$ $\frac{7}{100}$ $\frac{4}{25}$ $\frac{1}{5}$ $\frac{1}{2}$ $\frac{1}{4}$ $\frac{41}{100}$ $\frac{3}{20}$

Find each of the following.

	A	B	C
5.	17% of $160	66% of 300	50% of 5546
6.	40% of $81.55	2% of $3.50	30% of $5.50
7.	4% of $105.25	75% of 900	99% of $300

Extra Practice for Those Who Need It

8.	5% of $40	35% of $2.80	15% of $1
9.	80% of 70	44% of 465	33% of 892

Practice with Fractions and Decimals

1. 98 is ___ of 490.
2. 1.86 is ___ times .06.
3. 736 is ___ times 368.
4. 368 is ___ of 736.
5. .125 of 900 is ___.
6. $\frac{1}{4}$ is $\frac{1}{8}$ of ___.
7. 95 is $\frac{1}{16}$ of ___.
8. 1.2 is .6 of ___.
9. 45 is .05 of ___.
10. 1.5 times $\frac{1}{4}$ is ___.
11. One inch is what decimal fraction of 1 foot?
12. 12 ounces are what decimal fraction of 3 pounds?
13. 12 quarts are what decimal fraction of a bushel?

Reasonable Answers to Problems

1. Mr. Howard earned \$225 per month each month one year. That year he saved 10% of the amount he earned. How much of his earnings did Mr. Howard save that year?

Nancy Howard figured that her father had saved \$27 from his earnings that year. Mr. Howard said that common sense should tell her that her answer was not reasonable. What mistake do you think Nancy made?

When you solve problems, always think about your answers to decide whether or not they are reasonable.

2. In a certain factory 218 women are employed. These women are $\frac{2}{3}$ of all the persons employed in the factory. How many persons are employed in this factory?

Before you do any figuring in Problem 2, think first about your answer. Should it be larger than 218 or smaller than 218? How do you know? Should you divide 218 by $\frac{2}{3}$ or multiply 218 by $\frac{2}{3}$? Why?

You will find it easier to solve any problem if you think about the size of the answer before you begin to do any figuring.

3. Approximately 212,000 persons were employed in a large city one year. About 39% of these persons were employed in factories. About how many persons were employed in factories in that city that year?

In Problem 3 should your answer be less than $\frac{1}{2}$ of 212,000 or more than $\frac{1}{2}$ of 212,000? Why? How do you know that 8268 persons would not be a reasonable answer for the problem?

4. Mr. Peterson sold his farm and household goods at an auction sale and received a total of $4765 for them. He paid the auctioneer a 4% commission on the total amount. How much should he have paid the auctioneer?

How do you know without figuring that $19,060 is not a reasonable answer for Problem 4?

What mistake would you have to make to get $19,060 for your answer?

5. Mr. Neal works for the Ellis Machine Co. and earns $62.50 per week. He plans to set aside 10% of his salary to buy a new suit. How many weeks should it take him to save enough out of his salary to buy a suit that costs $75?

6. During the Community Fund drive the employees of the Mercer Co. were asked to donate $17,500 to the Community Fund. At the end of the first week of the drive the employees had donated 20% of this amount. They had donated $__ to the Community Fund at the end of the first week.

Why can you solve Problem 6 by finding $\frac{1}{5}$ of $17,500?

7. Dr. Myers had $3250 in accounts that had been owed him for many years. He promised to pay Mrs. Johnson a 12% commission on all that she could collect on these accounts. She collected $645. How much should she have kept for her commission?

8. How much should Mrs. Johnson have returned to Dr. Myers from her collections?

9. Would a salesman be likely to receive a commission of 100% on his sales? Why?

10. During the summer Alice earned money picking string beans. She was paid 2¢ a pound and picked an average of two 8-pound pails of beans per hour. She told her friend Mary that she earned $10.80 picking beans. About how many hours did she work?

11. Mr. Howe collects a 5% commission for selling property. How much commission should he receive for selling a house and lot for $8000?

Why would $4000 not be a sensible answer for Problem 11?

12. In 1944 the government asked farmers to plant 380,000,000 acres. This was 16,000,000 acres more than farmers were asked to plant in 1943. How many acres were they asked to plant in 1943?

13. A United States Savings Bond that sells for $18.75 is worth $25.00 in ten years. The cost of such a bond is what fraction of its value in ten years?

What is a good approximate answer for Problem 13? What is the exact answer?

14. A graduating class appointed four committees to raise money to give a bond costing $75 to their school. Tom's committee raised 50% of the money; Helen's committee raised 10%; Ann's committee raised 15%; and Jack's committee raised 25%. What is the sum of these per cents? How do you know without any more figuring that they raised $75?

15. How much money did each of the four committees raise? What should be the sum of the four amounts?

16. How could you use the fractions $\frac{1}{2}$, $\frac{1}{10}$, and $\frac{1}{4}$ in solving Problem 15?

Without Pencil

	A	B	C	D	E	F
1.	Subtract: 90 69	Multiply: 5yr. 4 mo. 3	.79 .21 .10	$4+\frac{1}{2}+7$	Area of a rectangle $9' \times 12'$ is ______.	50 % of 24 = ____
2.	Add: 347 654	$2\frac{1}{2} \times \frac{1}{5}$	A triangle has ____ sides.	$6 \div \frac{2}{3}$	$.89\overline{)4.45}$	$\frac{7}{8} - \frac{1}{4}$
3.	Subtract: $7\frac{1}{3}$ $\frac{2}{3}$	$4\frac{5}{12} = \frac{?}{12}$	$\frac{7}{8} \div 4$	$9 \times .45$	$\frac{54}{10}$ in simplest form is ____.	$\frac{1}{2} \times \frac{1}{16}$
4.	$\frac{1}{8}$ is what fraction of $\frac{1}{4}$?	Add: $5\frac{1}{12}$ $\frac{1}{3}$	Perimeter of a rectangle $6'' \times 10''$ is ______.	$48\overline{)289}$	Subtract: 513 67	Multiply: 24 31

Learning through Practice

1. $2\frac{2}{3}+4\frac{5}{6}+8+5\frac{1}{2}=$
2. $27\frac{1}{4}-19\frac{5}{12}=$
3. $.5382 \div 3.9=$
4. $76.710-74.072=$
5. $76 \times 804\frac{1}{4}=$
6. 16 ft. 3 in. $\div 3=$
7. $4\frac{1}{6} \times 1\frac{1}{5}=$
8. $1\frac{1}{2} \div 2\frac{1}{4}=$
9. 10×4 gal. 3 qt. $=$
10. $\frac{1}{4}+\frac{5}{6}+\frac{7}{12}+1\frac{1}{2}=$
11. $666 \div 69=$
12. $.22+.78+.73+.10=$

Extra Practice for Those Who Need It

13. $47\frac{1}{3} \times 5602=$
14. $198 \div 21=$
15. $9\frac{1}{10}-8\frac{1}{2}=$
16. $1.5984+.0099=$
17. $2\frac{1}{2} \div \frac{15}{16}=$
18. 8×14 lb. 12 oz. $=$
19. $\frac{5}{6}+\frac{1}{2}+5\frac{2}{3}+24\frac{1}{3}=$
20. $1178 \div 147=$
21. 7 bu. 2 pk. $\div 5=$
22. $.0972 \times 4.65=$

What must I find? Add? Multiply? Shall I subtract? Divide? Why? What numbers shall I use?

Problem Test 2

After you have finished these problems, find your score as you did for Problem Test 1. If you have forgotten how, read page 80 again.

1. Ann Reeve's home-town paper reported that the number of inches of rainfall for the first six months of the year was as follows: .66, 1.53, 4.16, 2.26, 5.08, 6.45. What was the total rainfall for these six months? *(3)*

2. A camping party planned to take 2 dozen cans of milk to camp. They set aside \$2.00 to buy the milk. They bought the milk at $7\frac{1}{2}$¢ a can. How much of the \$2.00 did they have left? *(4)*

3. During one week cakes of soap were given out as follows at the Lake City Pool shower baths: Sunday, 1308; Monday, 342; Tuesday, 784; Wednesday, 683; Thursday, 106; Friday, 1380; Saturday, 1298. Find the total number of cakes of soap given out that week. *(4)*

4. The factory whistle near John's home blows at 12:00 o'clock each day. John cannot hear it at his home until about $3\frac{1}{2}$ seconds after it starts to blow. Sound travels through the air at the rate of 1130 ft. per second. About how far from the factory does John live? *(5)*

5. Mr. Brandon bought some cattle for \$750. Three months later he sold them for \$1175. His expenses were as follows: care and labor, \$20 a month; grain and pasture, \$62 a month; other expenses of buying and selling, \$24. How much was his profit? *(5)*

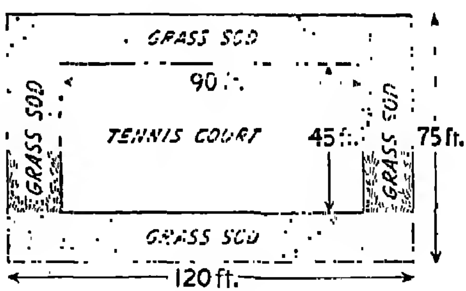
6. At a closing-out sale boys' shoes were sold at 65% of their regular price. The regular price for these was \$3.70. What was the closing-out sale price of the shoes? (*5*)

7. Mr. Hull's 200 hens laid an average of 18 eggs apiece during June. He sold these eggs for 32¢ a dozen. He spent \$42.50 for feed and \$11.25 for other expenses during the month. How much was his profit? (*6*)

8. In a Girl Scout camp at least 28 sq. ft. of floor space are required for each girl in a tent. The tents have floors 12 ft. by 14 ft. How many of these tents are needed for 16 girls? (*6*)

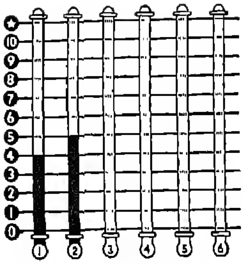
9. Mr. Westberg is a mailman and walks an average of 10 miles a day. He bought a pair of shoes at a cost of \$4. They lasted him 75 working days. During this time he spent \$1.25 in getting the shoes repaired. What was his cost per mile for shoes? (*8*)

10. A plan for a tennis court for the Lee School is shown at the right. Grass sod is to be put around the court, as shown on the plan. It sells at a rate of \$12 per 100 sq. ft. Find the cost of the sod for the court. (*8*)



Standards for Problem Test 2

Poor	Fair	Average	Good	Excellent
0–5	6–12	13–27	28–39	40–54



Self-Testing Drill 3

You will have exactly *20 minutes* for this drill. If you finish before the time is up, try "A Side-Trip in Mathematics" on page 130.

1. Subtract:
$$\begin{array}{r} 1595713 \\ \underline{608274} \end{array}$$

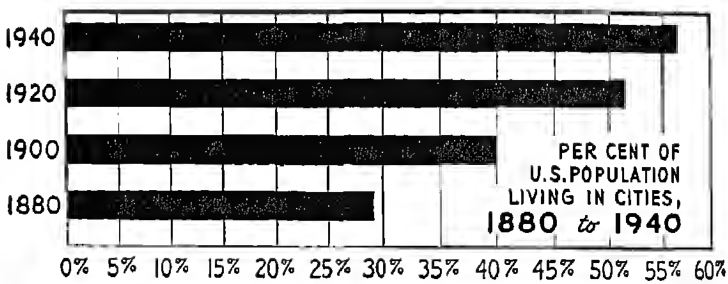
2. Subtract:
$$\begin{array}{r} 1551391 \\ \underline{946719} \end{array}$$

3. $3\frac{1}{2}-2\frac{1}{4}=$

4.
$$\begin{array}{r} 987 \\ 165 \\ 797 \\ 432 \\ 458 \\ \underline{401} \end{array}$$

5. $4\frac{1}{2}\div 3\frac{3}{5}=$

6. One summer James earned \$157. He saved 50% of this amount. How much did he save that summer?



7. Use the graph shown above to find the information that is missing on the lines below.

(*a*) Approximately __% lived in cities in 1880.
(*b*) Approximately __% lived in cities in 1900.
(*c*) Approximately __% lived in cities in 1940.
(*d*) In __ the per cent of the population living in cities was about twice that in 1880.

8. John said the difference between 51.4377 and 12.3869 is 19.0508. If he was wrong, give the correct answer. Write "Correct" on your paper if he was right.

9. How much is 10% of $926.00?

10. Multiply:

$$\begin{array}{r} 1072 \\ \underline{42} \end{array}$$

11. Subtract:

$$\begin{array}{l} \text{4 yd. 2 ft.} \\ \underline{\text{1 yd. } 2\tfrac{1}{2}\text{ ft.}} \end{array}$$

12.

$$\begin{array}{l} \text{2 yd. 2 ft.} \\ \text{3 yd.} \\ \text{6 yd. 1 ft.} \\ \underline{\text{4 yd. 2 ft.}} \end{array}$$

13. 3 T. 1000 lb. ÷ 5 =

14. $20.5 \times 46.1 =$

15. Find the average:

$$\begin{array}{r} 349 \\ 298 \\ 20 \\ 691 \\ 619 \\ \underline{255} \end{array}$$

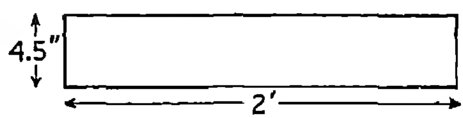
16. Divide 66816 by 768.

17. $6.49\overline{)2329.91}$

18. $9.48\overline{)827.604}$

19. $428\overline{)427}$

20. The area of the figure at the right equals how many square inches?



Example 7 is wrong if you have any part wrong.

Standards for Self-Testing Drill 3

Number Correct	0	1–5	6–7	8	9	10	11	12–13	14	15	16–19	20
Rating	0	1	2	3	4	5	6	7	8	9	10	★

Mark your Progress Chart. Is your work improving?

A Side-Trip in Mathematics

$$\begin{array}{rcr} 832 & \rightarrow & 4 \\ 608 & \rightarrow & 5 \\ 552 & \rightarrow & 3 \\ \hline 1992 & & 12 \\ \downarrow & & \downarrow \\ 3 & & 3 \end{array}$$

Hundreds of years ago the Arabs discovered an easy way to check addition. They checked their work by *casting out nines*, as explained below.

When you cast out nines, you add the figures in a number, subtracting 9 whenever you can.

To check the example above, first cast out nines in 832. $8+3=11$. Casting out 9, you have 2 left over. $2+2=4$. You cannot cast out 9 from 4. So you have 4 left over. Notice where the 4 is written.

1. Now cast out nines in 608. ___ is left over.

2. What do you get when you cast out nines in 552?

3. Next add the 4, 5, and 3. The sum is 12. Casting out nines in this number, you have ___ left over.

4. Now cast out nines in the answer for the example. What number is left over? How is it written? The figures with circles around them are the same; so 1992 is probably the correct answer.

5. Add in each example below. Then check your work by casting out nines.

	19		978	86	636	1373
86	15	238	808	1	845	5592
15	27	976	469	278	174	2474

86	968	996	9552	140	6704	5282
45	413	2438	1113	289	9151	9603
4	785	146	2735	208	1077	348
26	768	6797	4587	95	4715	6437

Checking Up

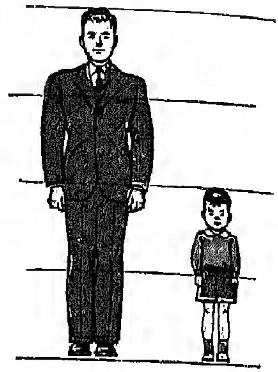
Before you begin the new work in Chapter 3, do the work on this page and on the next page to check up on how well you remember what you have learned.

1. Which fractions below are proper fractions?

   $\frac{13}{16}$ $\frac{29}{64}$ $\frac{8}{8}$ $\frac{11}{5}$ $\frac{19}{32}$ $\frac{27}{24}$ $\frac{9}{5}$

2. Write *four hundred billions* in figures.
3. Write *4635 millionths* as a decimal.
4. In the number 187,940,623, which figure is in the millions' place?
5. 12 is $\frac{2}{5}$ of what number?
6. .4 of what number is 12?
7. Should you use a bar graph or a line graph to show the weights of 10 boys? Why?
8. Are you more likely to get exact or approximate information from reading a graph?
9. If you were to make a line graph of the money you earned each month, should the horizontal scale represent months or money? Why?
10. In a bar graph, if a bar 1 in. long means \$5, how long a bar would mean \$12.50?
11. Change 1 mi. 1844 yd. to simplest form.
12. You can find the perimeter of a square by multiplying the length of one side by 4. Why?
13. Can you find the perimeter of any rectangle in the way mentioned in Problem 12? Why or why not?
14. Find the area of a rectangle 6 in. x 1 yd. 1 ft.
15. Is 615 A. more than, less than, or exactly 1 sq. mi.?

16. In the picture at the right, the boy's height is what fraction of the man's height?



17. The boy's height is what per cent of the man's height?

18. Which is smallest, $\frac{1}{16}$, 7%, or .06? 27%, $\frac{3}{16}$, or .18?

19. A meter is about __ inches longer than a yard.

20. A millimeter is what decimal fraction of a centimeter? A centimeter is what decimal fraction of a meter?

21. A kilometer is about what fraction of a mile?

22. 3 in. are what decimal fraction of 2 ft.?

23. $\frac{9}{100000}$ can be written as a decimal fraction with __ places. Read this decimal as 9 __.

24. Change $\frac{19}{64}$ to a decimal fraction. Round off the answer to the nearest thousandth.

25. What common fractions and what per cents are equal to the decimal fractions below?

.8 .2 .75 .25 .9 .1 .4 .7

26. What common fractions and what decimal fractions are equal to the per cents below?

70% 10% 50% 75% 25% 30% 6%

27. In .01437 the __ is in the ten-thousandths' place.

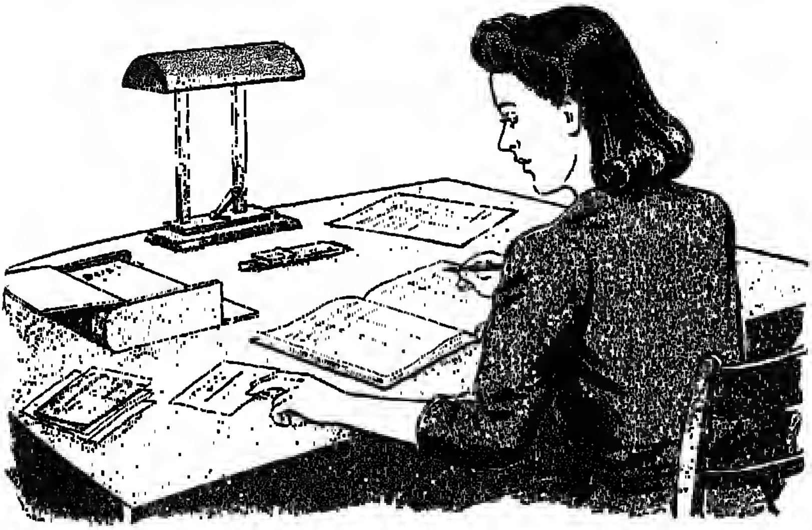
28. Jim planned to spend 10% of his money at a ball game, 60% for clothes, 15% for books, and 25% for tools. Could he have done this? Why?

29. 80 is $\frac{1}{3}$ of __.

30. 12 is __ of 60.

31. Find 92% of $140.

32. 87% of $12 is $__.



CHAPTER 3

Managing the Family's Income

Managing Means Planning

Few families have so much money that they can spend it in any way they like. Instead, most families must set aside certain parts of their incomes for food, shelter, clothing, taxes, and other expenses. Most of them also try to set aside part of their incomes for savings.

It is to a family's advantage to have a plan that shows how much money can be used each year for each of these purposes. By planning ahead in this way, and then following the plan carefully, a family can be reasonably sure that it will have money on hand for all necessary expenses. But no family can make or use such a plan unless someone keeps careful records of the family's income and expenses.

The woman in the picture on page 133 is keeping the family records. She knows how the family's income has been earned, how much has been spent, and how much has been saved. She sees to it that bills are paid on time, and she keeps the receipts to prove that bills have been paid.

In your home your father and mother probably plan ahead and decide how much of the family's income should be spent for food, clothing, taxes, and other important items. To do this, they must be able to estimate these expenses from year to year.

They must also decide how much should be saved and how much should be set aside for emergencies, such as illness or accident.

If a plan for using a family's income is to succeed, the home manager should try to make each dollar buy as much as possible. One way to do this is to buy food at the right time and in the right amounts so that nothing will be wasted.

Sometimes the home manager can buy articles that are on sale and cost less than usual. When this is done, money may be saved that can be used to buy other things. However, it is not wise to buy more than is needed or to buy goods of poor quality just because they are on sale at a special price.

The home manager can also make the family's money go further by paying bills promptly. A bill is sometimes reduced if it is paid before it is due.

Some persons may think that planning how to use money is a great deal of trouble. It is much less trouble, however, than being in debt or unable to pay bills, or never having money for extra needs.

1. How can a family estimate its expenses for a year in advance?

2. Will any of these expenses change from year to year? Why?

3. How can a person know how much money to save for doctor and hospital bills?

4. Sometimes a sudden illness means unusually high expenses. How can a family protect itself against such expenses?

5. Why is it not always wise to buy things just because they cost less than usual?

6. Some persons say that it will help you save if you handle your regular monthly savings as you do the bills you have to pay. What does this mean?

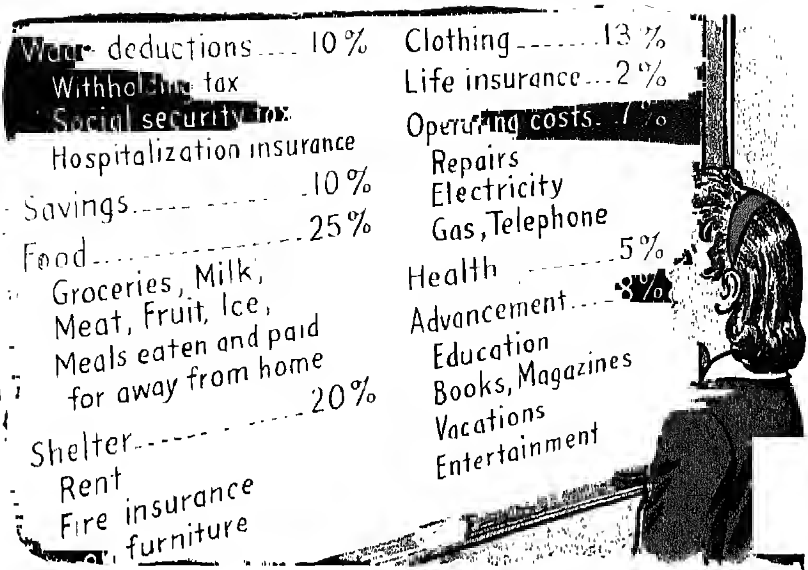
7. If a family has a small income, it is easy to see why the family should be careful not to waste anything. Should a family with a large income be just as careful? Why do you think so?

8. Many farm families get along on small cash incomes. Why is it easier for a farm family to do this than for a city family?

9. If a man buys government bonds regularly, do you think he should have other savings as well? Why?

10. Some persons with small incomes seem to get along better than others who have much larger incomes. Why?

11. The income of a doctor, a lawyer, a writer, a salesman, or an artist is likely to be irregular. How can such a person make a plan for a year's expenses?



The Family Budget

Early in 1947 the Daly family worked out a *budget*, or a plan for managing the money that Mr. Daly expected to earn during the year. They first *estimated* the year's expenses. This means that they figured the expenses as closely as they could.

Then they decided what per cent of Mr. Daly's salary of $2400 for the year should be used for each division of the budget. These per cents showed the part of each pay check that they planned to use for each budget division.

1. The budget that the family decided to use is shown above. Find the sum of all the per cents. Does the budget include all of Mr. Daly's salary?

2. The wage deductions were taken from Mr. Daly's salary before he received his pay check. Why were these deductions made?

Mr. and Mrs. Daly planned to save 10% of Mr. Daly's salary, and to buy war bonds and stamps with these savings. They agreed that if any extra money was earned during the year, they would put it in the bank.

3. Mrs. Daly thought that she could cut down the family's food costs by having a garden and by canning fruit and vegetables. She figured that 25% was a fair allowance for food during the year. What things were to be paid for out of this budget division?

4. The Daly family allowed 20% for shelter. This per cent might have had to be larger if they had lived in a big city. What did they include in this division of the budget?

5. Since Mrs. Daly hoped to make the dresses that she and Helen would need during the year, only 13% was allowed for clothing. What per cent was allowed for life insurance? For operating costs? For health? For advancement?

Mr. and Mrs. Daly did not expect to follow their budget exactly. For example, the amount allowed for food was 25% of Mr. Daly's salary, or 25% of \$2400, or \$600. Mrs. Daly planned to spend not more than \$600 for food. She hoped to spend less than \$600 by careful management.

6. Figure the amounts that Mr. and Mrs. Daly allowed for each of their nine main budget divisions. Use the per cents shown in the picture on page 136 and arrange the per cents and amounts in a table.

7. The sum of the amounts you found in Problem 6 should be \$2400. Why?

8. About how much does Mrs. Daly plan to spend for food each month?

9. If she spent less than the amount allowed one month, what should she do with the money left over?

10. Do operating costs depend partly on where the family lives? If so, why?

11. If Mr. and Mrs. Daly had owned their own home, shelter would have had to include taxes, insurance, repairs, and improvements on the house. How could they have estimated the amount to allow for these things?

12. Another family with an income of \$2400 might allow 10% for advancement. Why? Why would this family have to change the other per cents in its budget?

Mr. and Mrs. Daly kept careful records during 1947. Their total income for the year was \$2786 because of overtime that Mr. Daly worked. The table at the top of the next page shows how they actually used the money.

Wage deductions	$269.17
Savings	644.63
Food	591.18
Shelter	456.50
Clothing	318.28
Life insurance	48.00
Operating costs	152.00
Health	110.50
Advancement	195.74

13. For which budget divisions did the Daly family spend more than they had allowed? How did this probably happen?

14. For which budget divisions did they spend less money than they had allowed?

15. Their total savings amounted to $644.63 instead of the $240 they had planned to save. Where did the extra $404.63 come from?

16. During the year they had bought $240 worth of United States Savings Bonds and Stamps and had put $350.00 in the bank. At the end of the year they had $54.63 in cash. Where did the $54.63 come from?

17. What do you think would have been the wisest use of this $54.63? Why?

18. Would it be wise to buy bonds with all the money in the bank? Why or why not?

19. Did the budget work out well for the Daly family? Why do you think so?

20. In 1948 Mr. Daly's salary was $2400. He hoped to work as much overtime as he did in 1947. When he and his wife made their 1948 budget, should they have used the same per cents they used in 1947? Why?

21. If they used the same per cents, should they figure their food budget as 25% of $2400 or as 25% of $2786? Why?

Budgets for Boys and Girls

During vacation Dan plans to work in a store. He will earn $16 a week, and he expects to work for 6 weeks. He made the budget shown below to help him keep from wasting any of the money he earns.

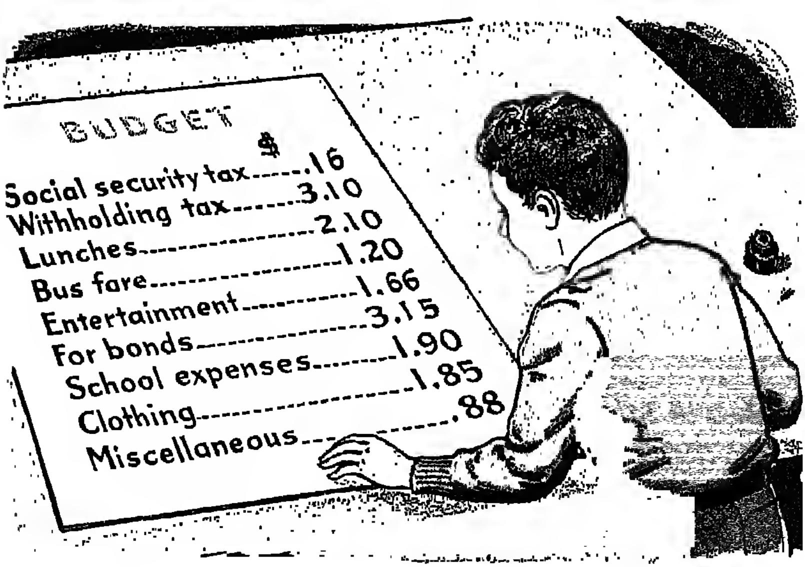
He also bought some envelopes and labeled one envelope for each budget division. In each envelope he will keep the money that belongs to the budget division written on the envelope.

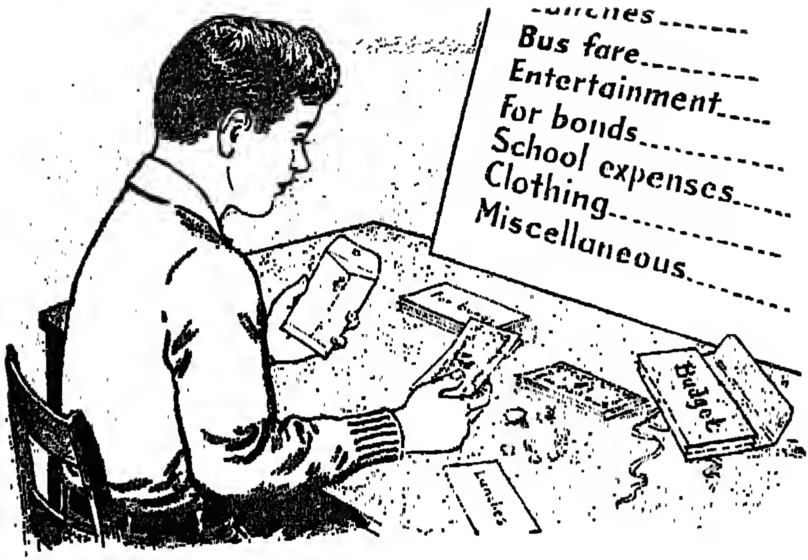
1. Why did Dan not need budget envelopes for his social security tax and his withholding tax?

2. Is Dan's budget a weekly or a monthly budget? How do you know?

3. Which amounts in his budget could Dan figure exactly? Which of them did he have to estimate?

4. Should Dan be able to buy an $18.75 bond at the end of 6 weeks? How do you know?





5. How much should Dan have in his envelope for school expenses at the end of the 6 weeks? Do you know how much he should have in his envelope for clothing?

6. List four things that Dan might pay for with money in the envelope marked "Miscellaneous."

7. Dan expects to work 6 days a week and to buy his lunch every day. He expects to pay an average of $__ per day for his lunch.

8. Dan will ride the bus twice each day. How much will each bus trip cost him?

9. Dan told his father that the amount he plans to save for a bond is almost 20% of his weekly salary. Was Dan right, or should he have said 19%?

10. Dan's older brother earns $24 per week. He also saves almost 20% of his salary to buy his bonds. Is this about the same amount of money that Dan plans to save? How do you know?

ESTIMATED FARM INCOME

Products to be Sold	Month of Sale	Quantity	Farm Price	Total Value
14 BABY BEEVES - HOME GROWN	DEC.	9100 lb.	$12.00	$1092.00
55 SPRING PIGS (225 lb. av.)	SEPT.	12,375 lb.	12.50	1546.88
22 FALL PIGS (225 lb. av.)	MARCH	4950 lb.	11.20	554.40
100 HENS (5 lb. av.)	SEPT.	500 lb.	.22	110.00
100 SPRING CHICKENS (3 lb. av.)	JULY	300 lb.	.25	75.00
EGGS (8 DOZ. PER HEN)	OCT.-JAN.	1600 doz.	.28	448.00
CORN		65 bu.	1.05	68.25
OATS		300 bu.	.72	216.00
WHEAT		300 bu.	1.30	390.00
Total Cash Income				$4500.53

Estimating Farm Income

Mr. Dawson operates his farm in a very businesslike way. He estimates his income from the farm and the expenses of running the farm in order to find out what income he can expect to receive for his family. This income is then carefully budgeted.

1. Mr. Dawson's estimate of farm income is shown above. He expects to receive income from __ sources.

2. When Mr. Dawson made this estimate, prices for farm products were unusually high. So he figured his prices lower than they were at the time he made his estimate. Was this wise? Why?

3. On calves and pigs, the prices Mr. Dawson put in the "farm price" column are per hundredweight, or for each 100 lb. To get the amount for the "total value" column opposite "14 baby beeves—home grown," he multiplied $12 by 91. Why? Is the $1092 correct?

4. Check each amount in the "total value" column. Are these amounts correct?

5. What was Mr. Dawson's estimated total income?

6. A summer drought might make the income fall to an amount 30% less than had been estimated. This would be how much less money than his estimated total income?

7. Mr. Dawson also estimated how much of his income would be needed for expenses. His estimated expenses are shown below. Is his total correct?

8. Next Mr. Dawson subtracted his estimated expenses from his estimated total income. What was he trying to find out? What should his answer have been?

9. Mr. Dawson estimated that the family would use $350 worth of home-grown products during the year. He felt that this $350 should be thought of as part of the farm income. Why? Should this $350 be added to the $2713.53, or should it be subtracted? Why?

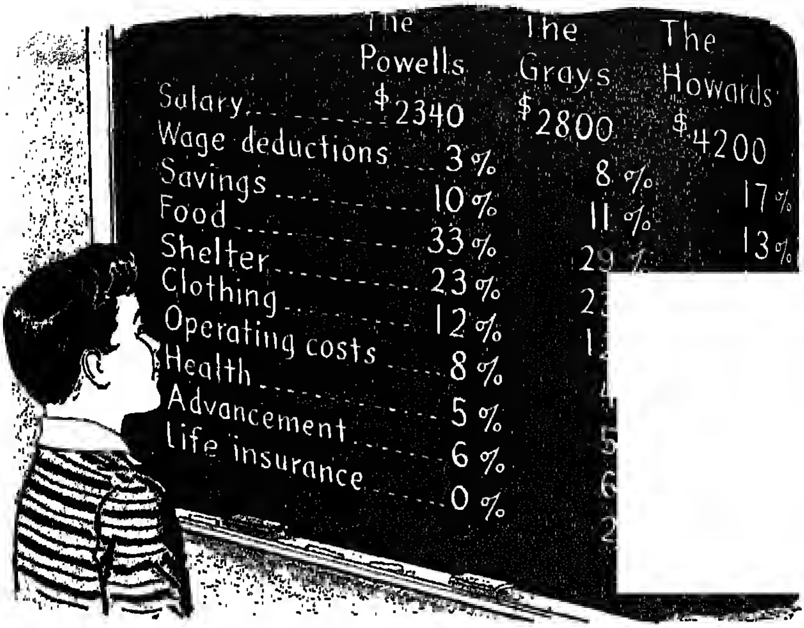
10. Mr. Dawson estimated that his income would be $__ after his estimated expenses had been paid. Since he farms 160 A., this is an income of $__ per acre.

11. The income from the farm is usually the largest part of a farm family's income. What other income might a farm family have?

12. The Dawsons save a large part of their income. Why is it wise for a farm family to do this?

ESTIMATED FARM EXPENSES

BUILDINGS, FENCES, FERTILIZER	$192.00
MACHINERY and EQUIPMENT, MOTOR FUEL, REPAIRS, CUSTOM WORK HIRED, ETC.	470.00
FEEDS PURCHASED	290.00
LIVESTOCK PURCHASED	150.00
OTHER LIVESTOCK EXPENSE, VETERINARY SERVICE, ETC.	50.00
CROP EXPENSE – SEEDS, ETC.	115.00
HIRED LABOR (5 MONTHS)	300.00
TAXES	190.00
MISCELLANEOUS	30.00
Total Expenses	$1787.00



Budgets for Different Incomes

This picture shows budgets for three families of four persons that Miss Snyder's class studied. Each budget shows the amount earned per year and the per cent allowed for each division of the budget.

1. Does each budget show all of the family's total salary? How do you know?

2. Make a table showing for each family the amount per year allowed for each division of the budget. Do this figuring very carefully. The sum of the amounts for each budget will equal the total estimated salary. Why? Keep the table to use later.

3. Do you think it was as easy for the Powells to save 10% of their income as for the Howards to save 13% of theirs? Why?

4. Which family allowed the largest per cent of its income for food? Which family allowed the largest amount for food?

5. Which family allowed the smallest per cent of its income for food? Which family allowed the smallest amount for food?

6. The family that allowed the largest per cent for food also allowed the smallest amount for food. How can this be?

7. The Powells allowed 33% for food, while the Grays allowed only 29%. Why did the Powells have to allow a larger per cent than the Grays? What determines the per cent of its income a family needs for food?

8. Each family expected to spend __% of its income for health. What amount did each family plan to spend for health?

9. The per cents allowed for health are the same, but the amounts allowed are different. Why?

10. Which two families allowed the same per cents for shelter? Did these two families allow the same amounts for shelter? Why?

11. Do you agree or disagree with the following statement? As a family's income increases, the *per cents* allowed for food, shelter, clothing, and operating costs should grow smaller; while the per cents allowed for savings, insurance, health, and advancement should grow larger. Explain your answer.

12. Would a family of six persons with an income of $2300 be likely to use the same budget as the Powell family of four persons? Why?

Think before You Answer

1. One family spent 15% of its income for food, and another spent 30%. Is it possible that these two families spent equal amounts for food? Why?

2. What big mistake was made in the budget that follows? Wage deductions, 7%; savings, 11%; food, 30%; shelter, 13%; clothing, 11%; operating costs, 5%; health, 5%; advancement, 6%; insurance, 2%.

3. In which budget division do you think the mistake was made? Why do you think so?

4. Last year the Dodds did not spend all the money they had allowed for health. What should they do with the money left over in this budget division? Why?

Without Pencil

	A	B	C	D	E	F
1.	$47\overline{)376}$	3 A. = ____ sq. rd.	Subtract: $3\frac{2}{3}$ $\underline{\frac{1}{3}}$	5.3 2.8 $\underline{.9}$	$\frac{5}{6} \div \frac{1}{5}$	.45 = ___%
2.	3 Kilograms = about _____ lb.	$\frac{5}{12} \times \frac{7}{10}$	8 ft. 7 in. 5 ft. 9 in. 4 ft. 3 in.	$1\frac{1}{16} + 1\frac{1}{8}$	$\frac{1}{6}$ is what fraction of $\frac{5}{6}$?	.49 × 8
3.	6240 ÷ 8	20 % of $400 = $_____	$\frac{4}{5}$ = ___%	$\frac{95}{5}$ in simplest form is _______	Perimeter of a 6-ft. square is _____ ft.	Add: $2\frac{1}{3}$ $\underline{3\frac{1}{5}}$
4.	4 is what decimal fraction of 12?	$4\frac{4}{5} \div \frac{3}{5}$	Subtract: 2001 $\underline{56}$	Are 80 in. more or less than 2 meters?	$3\frac{1}{3} \times \frac{1}{2}$	Multiply: 362 $\underline{7}$

Learning through Practice

1.

93		5043	$3\frac{11}{16}$	$\frac{7}{8}$	471.7	$1\frac{1}{5}$
4		2365	$\frac{5}{8}$	$\frac{3}{4}$	719.2	$2\frac{4}{5}$
78	$\frac{1}{6}$	107	$4\frac{1}{4}$	$\frac{1}{2}$	465.4	9
59	$\frac{2}{3}$	7425			283.7	

Subtract:

2.

\$6.27	$16\frac{5}{16}$	.96834	$721\frac{3}{8}$	1.000	$829\frac{2}{3}$
.50	$7\frac{3}{16}$	.61105	$382\frac{1}{2}$	.987	$54\frac{1}{8}$

Multiply:

3.

7.6	\$2.75	27	759	584	$93\frac{1}{3}$
1.9	87	$12\frac{5}{6}$	5.06	368	6

4. $1\frac{3}{4}\times2\frac{2}{3}$ $\quad 6\times3\frac{1}{2}$ $\quad 5\frac{1}{3}\times\frac{9}{10}$ $\quad 14\times\frac{2}{3}$ $\quad 1\frac{1}{2}\times7$

Divide:

5. $72\overline{)61059}$ $\quad 26\overline{)59800}$ $\quad 34\overline{)126.78}$ $\quad .033\overline{)782}$

6. $14\div\frac{1}{32}$ $\quad 8\div\frac{4}{5}$ $\quad 2\frac{3}{16}\div15$ $\quad 3\frac{3}{8}\div2\frac{1}{10}$ $\quad 3\div4\frac{1}{2}$

7. $5\div6\frac{2}{3}$ $\quad 4\frac{1}{2}\div\frac{3}{4}$ $\quad 3\frac{5}{16}\div\frac{1}{8}$ $\quad \frac{1}{5}\div\frac{1}{5}$ $\quad \frac{1}{5}\div5$

Write each of the following as a decimal fraction.

8. 10% 89% 54% 4% 25% 1% 99%

Write each of the following as a common fraction.

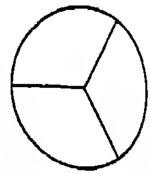
9. 5% 10% 75% 1% 47% 4% 99%

Write each of the following as a per cent.

10. $\frac{1}{4}$ $\quad .5$ $\quad \frac{1}{10}$ $\quad .36$ $\quad .03$ $\quad \frac{2}{5}$ $\quad \frac{9}{10}$ $\quad .40$

Mixed-Number Per Cents

Sam Forrest pays $\frac{1}{3}$ of his salary for his room and board. What per cent of his salary does he pay for room and board?



A

1. Circle A at the right shows all, or $\frac{3}{3}$, of Sam's salary. Circle A shows ___% of his salary.

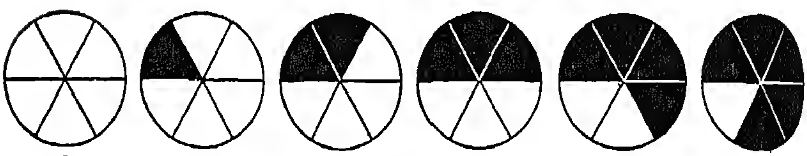
2. What part of Circle B shows the fraction of his salary that he pays for room and board?

B

3. He pays $\frac{1}{3}$ of 100%, or ___%, of his salary for room and board.

4. What part of Circle B shows the fraction of Sam's salary that is left?

5. He has $\frac{2}{3}$ of 100%, or ___%, of his salary left.



C D E F G H

6. Circle C above shows $\frac{6}{6}$, or ___%, of Joe's savings.

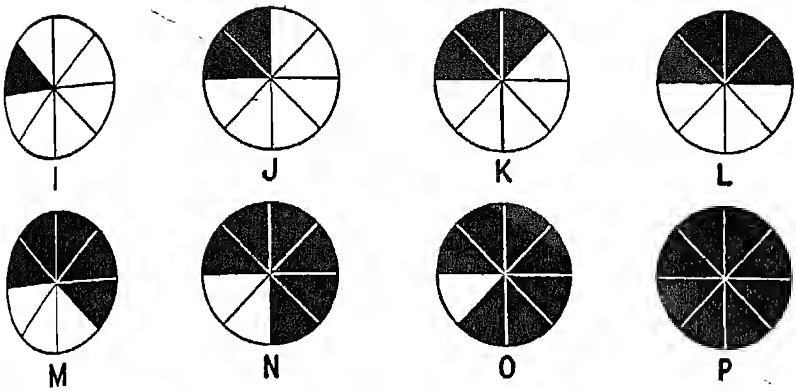
7. The black part of Circle D is $\frac{1}{6}$ of the circle. It is $\frac{1}{6}$ of 100%, or ___%, of the whole circle.

8. $\frac{2}{6}$ of 100%, or ___%, of Circle E is black.

9. How do you know that $\frac{1}{3}$ of Circle E is black?

10. $\frac{3}{6}$ of 100%, or ___%, of Circle F is black.

11. How do you know that $\frac{1}{2}$ of Circle F is black?



12. $\frac{4}{6}$ of 100%, or __%, of Circle G on page 150 is black.

13. How do you know that $\frac{2}{3}$ of Circle G is black?

14. $\frac{5}{6}$ of 100%, or __%, of Circle H is black.

15. Each circle above is divided into __ parts. Each part is __ of a whole circle.

16. For each circle above write both the fraction and the per cent that tell how much of the circle is black.

The table below shows eight fractions. For each of the fractions the per cent that is equal to it is also shown. You will find it convenient to learn these, just as you learned the ones on page 112.

$\frac{1}{3} = 33\frac{1}{3}\%$	$\frac{1}{6} = 16\frac{2}{3}\%$	$\frac{1}{8} = 12\frac{1}{2}\%$	$\frac{5}{8} = 62\frac{1}{2}\%$
$\frac{2}{3} = 66\frac{2}{3}\%$	$\frac{5}{6} = 83\frac{1}{3}\%$	$\frac{3}{8} = 37\frac{1}{2}\%$	$\frac{7}{8} = 87\frac{1}{2}\%$

What fractions and per cents are missing from the lines below?

17. $\_ = 83\frac{1}{3}\%$ **19.** $\_ = 16\frac{2}{3}\%$ **21.** $\frac{1}{4} = \_\%$

18. $20\% = \_$ **20.** $\_ = 62\frac{1}{2}\%$ **22.** $\_ = 37\frac{1}{2}\%$

Per Cents and Decimals

You learned on page 111 that 26% is equal to .26 because $26\% = \frac{26}{100}$, and $\frac{26}{100} = .26$.

A simple way to change 26% to an equal decimal is first to write 26 without the per cent sign. Then begin with the 6 in 26 and count two places to the *left*. Put a decimal point there. $26\% = .26$.

1. 3% equals .03 when you change it to a decimal. Why do you write a zero before the 3?

You change mixed-number per cents to equal decimals in the same way. *Do not count the fraction when you count the two places.* $16\frac{2}{3}\% = .16\frac{2}{3}$. $1\frac{5}{8}\% = .01\frac{5}{8}$.

2. Write a decimal equal to each per cent below.

Row A $18\frac{1}{2}\%$ $7\frac{1}{4}\%$ $99\frac{7}{10}\%$ 8% $1\frac{3}{5}\%$ $33\frac{1}{3}\%$

You change a fraction like $\frac{1}{2}$, $\frac{1}{4}$, $\frac{3}{4}$, $\frac{2}{5}$, or $\frac{9}{10}$ to an equal decimal by dividing the numerator of the fraction by its denominator. $\frac{1}{2} = .5$. $\frac{1}{4} = .25$. $\frac{1}{8} = .12\frac{1}{2}$.

3. Change each fraction below to an equal decimal.

Row B $\frac{3}{4}$ $\frac{2}{5}$ $\frac{9}{10}$ $\frac{3}{5}$ $\frac{5}{8}$ $\frac{1}{10}$ $\frac{3}{8}$ $\frac{4}{5}$ $\frac{7}{8}$

When you have a per cent like $12\frac{1}{2}\%$, you can write it as 12.5% if you want to.

4. Write each per cent below with a decimal instead of a common fraction.

Row C $11\frac{1}{4}\%$ $7\frac{3}{10}\%$ $93\frac{3}{4}\%$ $2\frac{7}{8}\%$ $5\frac{4}{5}\%$ $83\frac{1}{10}\%$

To write 12.5% as a decimal, move the decimal point two places to the left and omit the per cent sign. $12.5\% = .125$. $4.25\% = .0425$. Why do you use the 0?

5. Write each per cent below as a decimal.

Row D 14.6% 8.1% 93.25% 17.2% 46.75% 2.8%

6. Try to change the fraction $\frac{1}{3}$ to an equal decimal. When you divide 1 by 3, you get threes in the answer no matter how far you divide. You will always have $\frac{1}{3}$ as a remainder.

7. When you have a per cent with thirds, sixths, sevenths, or ninths in it, like $33\frac{1}{3}\%$ and $4\frac{1}{6}\%$, never try to change the fraction to an equal decimal. Why?

8. Now change each per cent below to an equal decimal.

Row E	$1\frac{1}{2}\%$	$16\frac{2}{3}\%$	$11\frac{7}{10}\%$	$9\frac{2}{5}\%$	$75\frac{1}{3}\%$	$87\frac{1}{2}\%$
Row F	$2\frac{3}{4}\%$	$19\frac{3}{10}\%$	$27\frac{5}{6}\%$	$5\frac{1}{4}\%$	$37\frac{1}{6}\%$	$10\frac{7}{8}\%$

To change a decimal to a per cent, first move the decimal point two places to the *right.* Then write a per cent sign after the number.

9. $.425 = 42.5\%$. Why can you also write this as $42\frac{1}{2}\%$? Why can you write .016 as 1.6%?

10. Change each decimal below to an equal per cent.

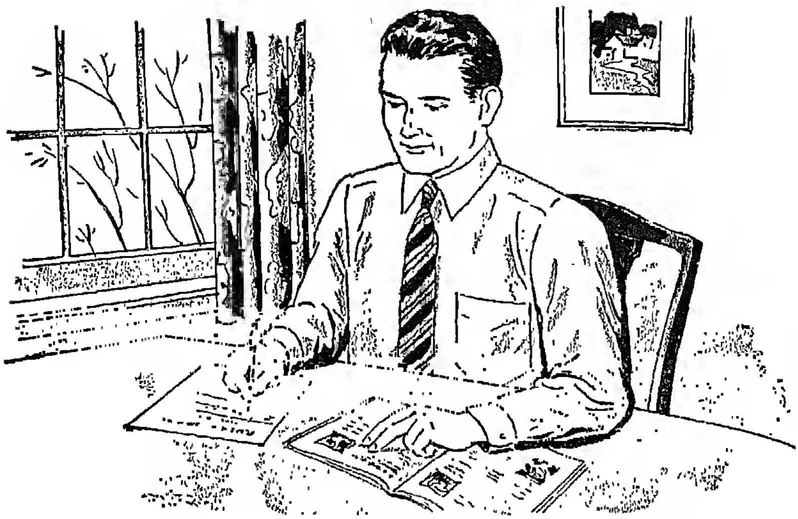
Row G	.337	.4825	.067	.5924	.011
Row H	.0225	.8175	.908	.026	.3285

11. .37 becomes 37.% when you change it to a per cent. 37.% is always written simply as 37%. Why?

12. Change each decimal below to an equal per cent.

Row I	.03	.77	.82	.90	.65	.6
Row J	.65	.01	.24	.05	.11	.4

To change $.83\frac{1}{3}$ to an equal per cent, move the decimal point __ places to the right. *Do not count the fraction when you move the decimal point.* $.83\frac{1}{3} = 83\frac{1}{3}\%$.



The Meaning of Discount

In January Mr. Mallon ordered seeds worth \$15 at regular catalog prices. A notice in the catalog said that during January the seed company charged $16\frac{2}{3}\%$ less than the catalog prices.

To find what he saved by ordering in January, Mr. Mallon found $16\frac{2}{3}\%$ of \$15, as in Example A. He multiplied \$15 by $.16\frac{2}{3}$. How did he get $.16\frac{2}{3}$?

A

$16\frac{2}{3}\%$ of \$15 =

$.16\frac{2}{3} \times \$15 = \$2.50$

$\$15.00 - \$2.50 = \$12.50$

Is \$2.50 the correct answer for $.16\frac{2}{3} \times \$15$? Mr. Mallon saved \$2.50 by ordering his seeds in January.

This \$2.50 is the *amount of discount* he received. His *rate of discount* was $16\frac{2}{3}\%$.

To find the cost of the seeds, Mr. Mallon subtracted \$2.50 from \$15.00. How much did the seeds cost?

The *net price* of the seeds was \$12.50.

1. If Mr. Mallon had waited until February to order his seeds, his discount would have been only 12%. How much would the $15 worth of seeds have cost him in February?

B

12% of $15 =

.12 × $15 = $1.80

$15.00 − $1.80 = $13.20

Find __% of $15, as in Example B.

How do you change 12% to .12?

Next multiply __ by __.

Does .12×$15 equal $1.80?

In February Mr. Mallon's discount would have been $__.

The net price of the seeds would have been $__.

Use Self-Help Examples C, D, and E at the top of the next page to check the work you do when you solve Problems 2, 3, and 4 below.

2. Mrs. Abbey bought a coat at an 8% discount. The regular price of the coat was $27.35. What price did Mrs. Abbey pay?

How do you know that the amount of discount in Problem 2 is closer to $2.19 than to $2.18?

3. A fur coat regularly priced at $270 was on sale at a discount of $33\frac{1}{3}$%. What was the sale price of this coat?

If you want to, you can use a fraction to find the discount in Problem 3. What fraction can you use?

4. Jane bought a pair of shoes that had been priced at $4.80 at a $12\frac{1}{2}$% discount. How much did she pay for the shoes?

You can use .12$\frac{1}{2}$, .125, or $\frac{1}{8}$ to find the discount in Problem 4. Why?

C	D	E
8% of \$27.35 =	$33\frac{1}{3}$% of \$270 =	$12\frac{1}{2}$% of \$4.80 =
.08 × \$27.35 = \$2.1880	.$33\frac{1}{3}$ × \$270 = \$90	.$12\frac{1}{2}$ × \$4.80 = \$.60
\$27.35 − \$2.19 = \$25.16	\$270 − \$90 = \$180	\$4.80 − \$.60 = \$4.20

The catalog prices and rates of discount on twelve seed orders are given below. Find the net price of each order.

5. \$10; 15%
6. \$7.50; $16\frac{2}{3}$%
7. \$11; 2%
8. \$10; 7%
9. \$8; $16\frac{2}{3}$%
10. \$4.75; 20%
11. \$5; $16\frac{2}{3}$%
12. \$12.50; 5%
13. \$14; 10%
14. \$284; 30%
15. \$18.60; 2%
16. \$100; $33\frac{1}{3}$%

Saving through Discounts

1. The Star Sporting Goods Store sold football shoes at 20% less than the regular price. Richard bought a pair that usually sold at \$5.98. How much did he save? What did he pay for the shoes?

2. For one day a large store sold everything at a 2% discount. Mrs. Cook bought 3 yd. of dress goods at this store. The regular price was \$1.30 a yard. Find how much she saved on the dress goods.

3. Mrs. Hall bought a blanket at a special sale. She received a 10% discount on the regular price of \$13.50. What was the sale price of the blanket?

4. During vacation Jim Hall worked in a store. He could buy anything in the store at a 20% discount. Find what a \$1.25 box of fancy soap would have cost.

5. Jim bought a leather jacket in the store. Its regular price was \$11.75. How much should Jim have paid for the jacket?

6. Jim also bought a red pullover sweater that was priced at \$6.50. Find how much Jim should have paid for the sweater.

7. The Towne Gift Shop sold pottery at $\frac{1}{2}$ off at a sale. What was the rate of discount? How much did a \$3 vase cost during this sale?

8. The Home Furniture Store sold rugs at 35% off the regular price. Find the net price of a \$68 rug during this sale.

9. Mr. Tenney bought three shirts. These shirts usually sold at \$2.25 each but were on sale at a 20% discount. How much did all three shirts cost?

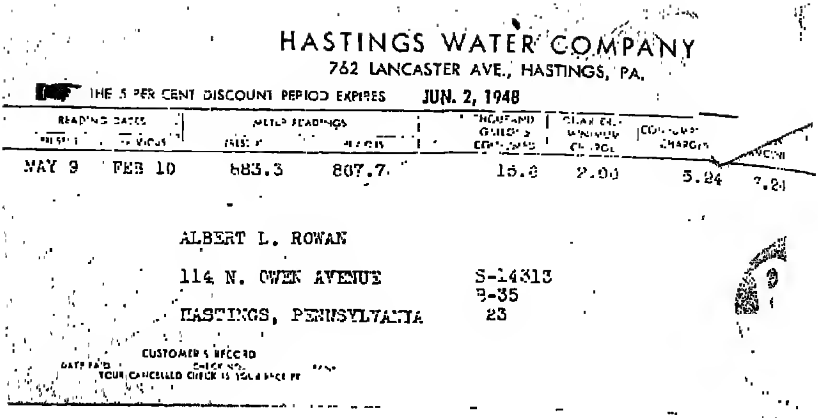
10. Mrs. Ward bought some glassware at a discount of $33\frac{1}{3}\%$. This glassware would have cost \$9.50 at the regular price. Find its cost at the sale price.

11. Peggy Knox bought a summer dress late in August. It had been priced at \$12.95 but because of the season was on sale at a 25% discount. What was the sale price of the dress?

12. A tablecloth priced at \$8.75 was put on sale at a discount of $33\frac{1}{3}\%$. What was the sale price?

13. Another tablecloth priced at \$10.25 was sold at 20% off. Find the sale price.

14. Mr. Harris bought a lot priced at \$850. Because he could pay cash, he was given a 10% discount on the price. How much did he pay for the lot?



HASTINGS WATER COMPANY
762 LANCASTER AVE., HASTINGS, PA.
THE 5 PER CENT DISCOUNT PERIOD EXPIRES JUN. 2, 1948

Reading Dates: Present	Reading Dates: Previous	Meter Readings: Present	Meter Readings: Previous	Thousand Gallons Consumed		Consumer Charges	
MAY 9	FEB 10	683.3	807.7	15.8	2.00	5.24	7.24

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HASTINGS, PENNSYLVANIA 3-35
23

CUSTOMER'S RECORD

Watching Discounts on Bills

In the morning on June 2 Mrs. Rowan sent Joe to the office of the water company to pay the bill shown above. She said that if the bill was paid before the office closed that day, the water company would give them a discount on the bill.

When Joe looked at the bill, he asked, "Shall I pay the company $7.24 or $6.88?"

"Pay them $6.88," answered his mother. "That is what we owe after the discount for prompt payment has been subtracted."

1. Mrs. Rowan gave Joe $10. How much money should Joe have returned to his mother?

2. $7.24 is the *gross amount* of this bill. What is the *net amount* of the bill?

3. Would the gross amount or the net amount have been due on Friday, June 4?

4. The rate of discount on this bill is __%.

5. Would the rate of discount change if the Rowan family should use more water during June? Would the amount of discount change? Why?

When Joe came home, his mother showed him some other bills that allowed discounts. She said that she saved about $1 through discounts every month. One of the old bills is shown in the picture below. This bill was received on Oct. 1.

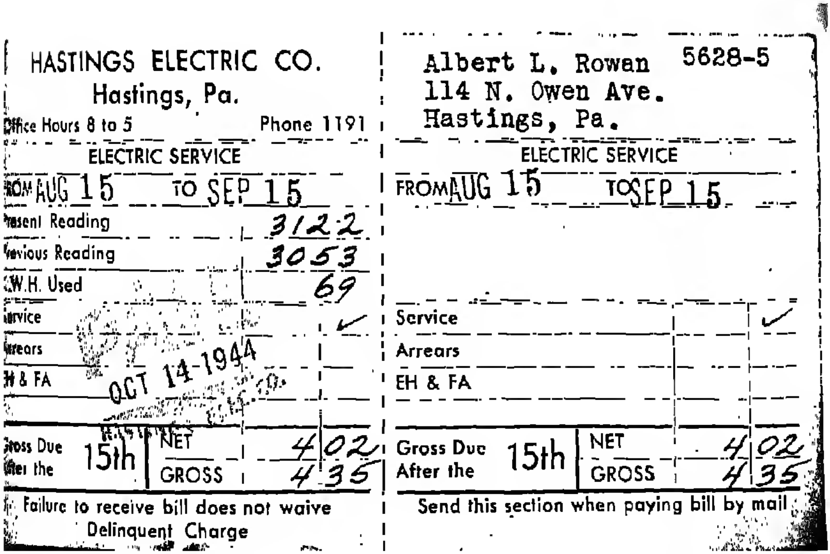
6. What was the bill for? The gross amount of the bill was $__. What was the net amount? How can you find the amount of the discount?

7. How could Mrs. Rowan have known when the gross amount would be due instead of the net amount?

8. How can you tell that the bill has been paid? When was it paid? How much should have been paid?

9. Another water bill showed $8.16 as the gross amount. The rate of discount was 5%. What was the amount of discount? Mrs. Rowan paid the net amount. How much should she have paid?

10. Do your parents receive discounts on any bills? If so, what rates of discounts do they receive? About how much do your parents save by such discounts?


HASTINGS ELECTRIC CO.
Hastings, Pa.
Office Hours 8 to 5 Phone 1191
ELECTRIC SERVICE
ROM AUG 15 TO SEP 15
resent Reading 3122
revious Reading 3053
.W.H. Used 69
ervice ✓
rrears
H & FA
OCT 14-1944
ross Due fter the 15th NET 4 02 GROSS 4 35
Failure to receive bill does not waive Delinquent Charge

Albert L. Rowan 5628-5
114 N. Owen Ave.
Hastings, Pa.
ELECTRIC SERVICE
FROM AUG 15 TO SEP 15
Service ✓
Arrears
EH & FA
Gross Due After the 15th NET 4 02 GROSS 4 35
Send this section when paying bill by mail

MURRAY RADIO COMPANY

65 NORTH AVENUE
HASTINGS, PA.

To Albert L. Rowan
114 N. Owen Avenue

June 1, 1948

2%, 10 Days

May	22	1 Peerless Radio	35	00

After looking at the bill shown above, Joe asked, "What does 2%, 10 days mean?"

"It means that a discount of 2% will be allowed if the bill is paid within 10 days," answered his mother. "Your father will pay this bill before June 10."

11. What is the rate of discount on this bill?

12. Will Mr. Rowan be allowed the discount? If so, how much should he subtract from the bill?

13. Be ready to explain the discounts on any bills that you have been able to find.

Think before You Answer

1. A coal company offers a discount on all coal bought during July and August. What reasons might the company have for doing this?

2. Why do many businesses give discounts on bills that are paid on or before a certain date?

3. How might the giving of a discount help a store to sell large amounts of its goods?

4. Are all discounts given as per cents?

Learning through Practice

1.	97			96		
	24	\$5.87	\$ .84	73		
	32	4.57	3.21	55	20.52	8.23
	47	4.33	2.08	46	9.77	12.17
	95	6.85	1.76	23	23.98	.05
	56	4.03	9.60	45	90.64	49.28

2.	4	$1\frac{1}{8}$	$\frac{3}{4}$	14	$12\frac{7}{8}$	9	$7\frac{1}{2}$
	$5\frac{1}{2}$	$2\frac{1}{3}$	$\frac{1}{3}$	$1\frac{3}{5}$	$\frac{1}{8}$	$2\frac{3}{5}$	$\frac{1}{12}$
	$1\frac{2}{3}$	$\frac{1}{2}$	$\frac{11}{12}$	$16\frac{9}{10}$	$\frac{1}{2}$	$1\frac{4}{5}$	$4\frac{1}{6}$

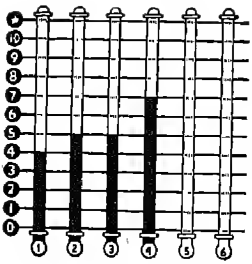
Subtract:

3.	724	8363	\$87.35	956.43	4635.00
	356	497	58.68	.58	698.75
4.	.234	7252	\$92.71	248.73	94851
	.158	4873	64.72	.96	35296

5. $6.7\overline{)24.12}$ $\quad 17\overline{)7}$ $\quad .54\overline{)27}$ $\quad 14\overline{)130}$

6. $38\overline{)182.081}$ $\quad 4.5\overline{)3}$ $\quad 23\overline{).184}$ $\quad 39\overline{)197.238}$

	A	B	C	D	E
7.	$18+12\frac{7}{8}$	$\frac{3}{8}-\frac{1}{6}$	$2\frac{1}{4}\times\frac{2}{5}$	$\frac{2}{3}\div 2$	$4\frac{1}{5}-3$
8.	$\frac{1}{8}\times 16$	$\frac{5}{8}\div\frac{1}{6}$	$\frac{9}{10}\times 4\frac{1}{6}$	$\frac{1}{2}+\frac{5}{6}$	$10\frac{1}{2}\div\frac{3}{4}$
9.	$2\frac{3}{4}+1\frac{2}{5}$	$3\frac{1}{6}-\frac{5}{6}$	$1\frac{11}{12}-\frac{1}{4}$	$4\div\frac{7}{8}$	$1\frac{1}{6}\div 1\frac{2}{5}$
10.	$4\frac{1}{2}-3\frac{2}{3}$	$3\frac{1}{4}+\frac{1}{4}$	$5\times\frac{3}{10}$	$\frac{2}{5}\times 1\frac{7}{8}$	$\frac{9}{10}\div\frac{15}{16}$
11.	$\frac{1}{6}\times\frac{3}{16}$	$7\frac{1}{5}\div\frac{1}{10}$	$2\frac{1}{2}\times\frac{7}{8}$	$1\frac{5}{12}-\frac{2}{3}$	$4\frac{5}{8}+5\frac{7}{10}$



Self-Testing Drill 5

You will have exactly *20 minutes* for this drill. If you finish before the time is up, try "A Side-Trip in Mathematics" on page 163.

1. Subtract:

$$\begin{array}{r} 622.024 \\ \underline{603.785} \end{array}$$

2. Subtract:

$$\begin{array}{r} 1075572 \\ \underline{849759} \end{array}$$

3.

$$\begin{array}{c} \frac{1}{6} \\ \frac{1}{2} \\ \underline{\frac{7}{12}} \end{array}$$

4.

$$\begin{array}{r} 761 \\ 889 \\ 437 \\ 926 \\ \underline{423} \end{array}$$

5. How much is a 15% discount on a bill of $504?

6. Change each mixed number below to an improper fraction:

(*a*) $4\frac{1}{8}$ (*b*) $5\frac{3}{4}$ (*c*) $3\frac{2}{5}$

7.

$$\begin{array}{r} \$6.84 \\ 3.45 \\ 4.45 \\ 9.14 \\ 4.56 \\ \underline{3.37} \end{array}$$

8.

$$\begin{array}{rl} 2 \text{ lb.} & 10 \text{ oz.} \\ 4 \text{ lb.} & 8 \text{ oz.} \\ 1 \text{ lb.} & 14 \text{ oz.} \\ \underline{4 \text{ lb.}} & \underline{9 \text{ oz.}} \end{array}$$

9. Subtract:

$$\begin{array}{r} 45\frac{1}{3} \\ \underline{37\frac{7}{12}} \end{array}$$

10. $2\frac{1}{2} \times 6\frac{2}{5} =$

11. Is $375 \div \frac{1}{2}$ equal to 7500, 750, or 187.5?

12. Multiply:

$$\begin{array}{r} 2 \text{ lb. } 3 \text{ oz.} \\ \underline{6} \end{array}$$

13. Multiply:

$$\begin{array}{r} 6.79 \\ \underline{274} \end{array}$$

14. $549\overline{)29.0421}$

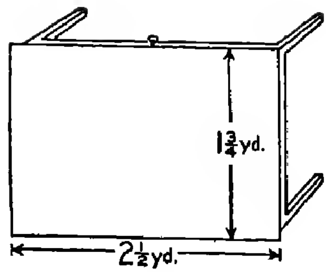
15. $984\overline{)566784}$

16. $78 \times 9073 =$

17. The Wilson School Improvement Club earned $494 during the year. 75% of this amount was saved. How much was saved?

18. $829 \times 2.594 =$

19. What is the area of the top of this table?



20. Change each of the following to simplest form.
   (*a*) 3 hr. 500 min.
   (*b*) 1 ft. 14 in.
   (*c*) 3 pk. 15 qt.

Examples 6 and 20 are wrong if any part is wrong.

Standards for Self-Testing Drill 5

Number Correct	0	1–5	6–7	8–9	10	11	12	13–14	15	16–17	18–19	20
Rating	0	1	2	3	4	5	6	7	8	9	10	★

A Side-Trip in Mathematics

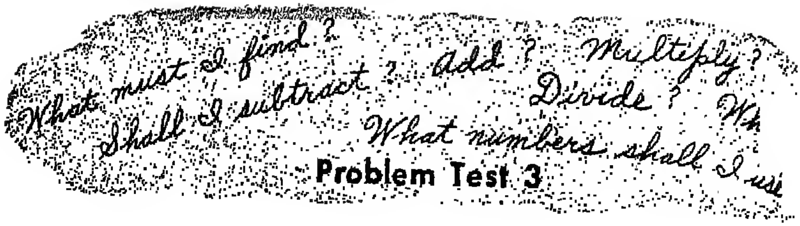
When each of two fractions has 1 for its numerator, the fractions can be added very easily in your head.

To add $\frac{1}{3}$ and $\frac{1}{4}$, first add the denominators. $3+4=7$. 7 is the numerator of your answer. Next multiply the denominators. $3 \times 4 = 12$. 12 is the denominator of your answer. $\frac{1}{3}+\frac{1}{4}=\frac{7}{12}$.

To add $\frac{1}{3}$ and $\frac{1}{5}$, first add __ and __ for the numerator. Then multiply __ by __ for the denominator. $\frac{1}{3}+\frac{1}{5}=$ __.

Do the examples below in your head and write down your answers. Sometimes you will have to change your answers to simplest form. Check your answers by adding the fractions in the usual way.

1. $\frac{1}{3}+\frac{1}{6}$	4. $\frac{1}{5}+\frac{1}{2}$	7. $\frac{1}{4}+\frac{1}{6}$	10. $\frac{1}{2}+\frac{1}{3}$
2. $\frac{1}{5}+\frac{1}{4}$	5. $\frac{1}{10}+\frac{1}{4}$	8. $\frac{1}{8}+\frac{1}{5}$	11. $\frac{1}{5}+\frac{1}{6}$
3. $\frac{1}{4}+\frac{1}{8}$	6. $\frac{1}{3}+\frac{1}{8}$	9. $\frac{1}{10}+\frac{1}{16}$	12. $\frac{1}{6}+\frac{1}{8}$



Problem Test 3

1. An agent received a 5% commission for selling a horse for Mr. Benedict. The agent sold the horse for \$120. How much was his commission? (3)

2. At a sale Jerry bought a pair of shoes that had been priced at \$4.50. He was allowed a discount of $33\frac{1}{3}\%$. How much did he pay for the shoes? (4)

3. The McKay Wholesale Company allows a 2% discount for payment of bills within 10 days. Mr. Harrison received a bill for \$74.40 from this company and paid it within the 10-day period. Find the amount he saved. (4)

4. Last year Mr. Trent traveled 2769 mi. on business in his automobile. He said that he averaged 14.2 mi. per gallon of gasoline. How many gallons of gasoline did he use on his business trips last year? (5)

5. Mr. Forbes of Somerset Farm shipped 1450 bu. of oats to the Farmers' Elevator. The elevator sold the oats at 63¢ per bushel and charged a commission of \$22.84 for selling it. Freight charges amounted to \$97.65. The Farmers' Elevator took the commission and freight out of the money received for the oats and sent the remaining amount to Mr. Forbes. How much should Mr. Forbes have received? (5)

6. A land agency sold 368 acres of land for Mr. Moore at \$79 per acre. The rate of commission was $4\frac{1}{2}\%$. Find the agency's commission on this sale. (6)

7. When migrating, a wild duck flew at the rate of 47 miles per hour. A homing pigeon flew at the rate of 55 miles per hour. In 5 hours the homing pigeon flew how much farther than the wild duck? *(6)*

8. Jordan's Hardware Store advertises a 12% discount on 50-ft. lengths of garden hose. The regular price is $5.50. Warden's Department Store offers the same kind of hose for $5.00 with a 5% discount. Which price is the better and by how much? *(7)*

9. John learned that the shot used in the school shot-put contest weighs 8 lb. About how many kilograms does the shot weigh? *(7)*

10. Sam needs boards of the following lengths for repairing his boat: 2 pieces, 3 ft. 0 in.; 3 pieces, 4 ft. 8 in.; 2 pieces, 5 ft. 4 in. Find the total length that he needs, allowing an extra 1 inch for sawing and fitting each piece. *(8)*

Standards for Problem Test 3

Poor	Fair	Average	Good	Excellent
0–5	6–15	16–30	31–42	43–55

Practice with Per Cents

Find each of the following amounts.

	A	B	C
1.	$66\frac{2}{3}\%$ of $17.99	$16\frac{2}{3}\%$ of $.75	25% of $125
2.	$12\frac{1}{2}\%$ of $29.95	1% of $16.75	4% of $55
3.	$87\frac{1}{2}\%$ of $497.50	14% of $95	10% of $.98
4.	$83\frac{1}{3}\%$ of $1900	$37\frac{1}{2}\%$ of $398	$62\frac{1}{2}\%$ of $42
5.	$6\frac{1}{4}\%$ of $24.50	$37\frac{1}{2}\%$ of $159	3% of $84

Comparing Per Cents and Amounts

In the pictures on page 167 you can see how Sam got mixed up when he and Roy were comparing per cents and amounts.

The boys discovered two things. The first was that they could compare any two amounts or any two per cents. The second was that they had to be careful not to talk as though they were comparing amounts when they were really comparing per cents.

In Picture 2, Sam compared 10¢ with 30¢. He did this by finding what fraction 10¢ is of 30¢. 10¢ is $\frac{10}{30}$, or $\frac{1}{3}$, of 30¢. This is the same as dividing 10 by 30. $10 \div 30 = \frac{1}{3}$.

1. Sam could also have compared 30¢ with 10¢ by finding what fraction 30¢ is of 10¢. 30¢ is $\frac{30}{10}$ of 10¢, or 3 times 10¢. Could Sam have simply divided 30 by 10?

2. How is Sam's statement in Picture 3 different from the statement he made in Picture 1?

3. What did Roy mean in Picture 4 when he said, "We have to be sure that we are comparing the things we say we are comparing"?

4. Read Pictures 5 and 6. Did Roy compare per cents or amounts in Picture 5? Did Sam compare per cents or amounts in Picture 6?

5. What did Roy mean when he answered Sam's question in Picture 6?

6. If Tom's allowance had been 40¢, could Roy have compared 60% with 20% in Picture 5? Why? Could Sam have compared amounts in Picture 6? Would the two answers have been the same this time? How do you know?


I SPEND 40% OF MY ALLOWANCF FOR UNITED STATES SAVINGS STAMPS, AND YOU SPEND 20% OF YOURS FOR STAMPS.
IT LOOKS AS THOUGH I SPEND ½ AS MUCH FOR STAMPS AS YOU DO, BECAUSE MY 20% IS ½ OF YOUR 40%.
1
THAT CAN'T BE RIGHT. I SPEND 40% OF 75¢, OR 30¢. YOU SPEND 20% OF 50¢, OR 10¢.
WHY, I REALLY SPEND ONLY ⅓ AS MUCH FOR STAMPS AS YOU DO!
2
BUT I COULD SAY THIS: THE PER CENT OF MY ALLOWANCE THAT I SPEND FOR STAMPS IS ½ OF THE PER CENT THAT YOU SPEND FOR STAMPS.
I GUESS YOU'RE RIGHT ABOUT THAT.
3
OH, I SEE NOW! WE CAN COMPARE THE PER CENTS, ALL RIGHT, AND WE CAN COMPARE THE AMOUNTS, TOO. BUT WE MUSTN'T MIX THEM UP, BECAUSE THEY ARE TWO DIFFERENT THINGS.
THAT'S RIGHT. WE HAVE TO BE SURE THAT WE ARE COMPARING THE THINGS WE SAY WE ARE COMPARING.
4
TOM'S ALLOWANCE IS 50¢, JUST LIKE YOURS, AND HE SPENDS 60% OF IT FOR STAMPS. 60% IS 60/20 OF 20%, OR 3 TIMES 20%. SO THE PER CENT HE SPENDS IS 3 TIMES THE PER CENT THAT YOU SPEND.
THAT'S RIGHT. YOU COMPARED THE PER CENTS.
5
LET'S SEE NOW. TOM SPENDS 30¢ FOR STAMPS, AND I SPEND 10¢. HE SPENDS 3 TIMES AS MUCH FOR STAMPS AS I DO. HOW DOES IT HAPPEN THAT WE GET THE SAME ANSWER WHEN WE COMPARE THE AMOUNTS THAT WE DID WHEN WE COMPARED THE PER CENTS?
THAT'S BECAUSE WE COMPARED PER CENTS OF THE SAME AMOUNT THIS TIME.
6

To compare two numbers, find what fraction one number is of the other. Sometimes the answer is a proper fraction. Sometimes it is an improper fraction that can be changed to a whole number or to a mixed number.

7. Ann spent 20% of her \$20 savings for a dress. Susan spent 25% of her \$24 savings for a dress. How can you compare the costs of the two dresses?

8. Compare the costs. Give the answer in two ways.

9. If you compare the 20% that Ann spent with the 25% that Susan spent, you get $\frac{4}{5}$. Why can you not say that Ann's dress cost $\frac{4}{5}$ as much as Susan's?

10. Make a statement that tells what the $\frac{4}{5}$ means.

11. Ted spent 25% of his \$20 savings for shoes, and Joe spent 20% of his \$20 savings for shoes. Since 25% is $1\frac{1}{4}$ times 20%, can you say that Ted's shoes cost $1\frac{1}{4}$ times as much as Joe's shoes? Why or why not?

12. Compare the costs of Ted's and Joe's shoes. Give your answer in two ways.

13. Compare 15% of \$60 with 25% of \$80. Give your answer in two ways.

14. Compare 24% of \$168.17 with 72% of \$168.17. Take a hint from Picture 6 on page 167 and do it the easier way. Give your answer in two ways.

Meaning of Per Cents Larger than 100%

1. Look at Diagram A on the next page. Ruth drew this circle to represent all of her earnings in 1947. These earnings may also be represented by $\frac{2}{2}$, by 1, and by 100%. Why?

2. Then Ruth drew Diagram B to show how her 1948 earnings compared with her 1947 earnings. How does Diagram B show that her 1948 earnings were $1\frac{1}{2}$ times her 1947 earnings? You may also say that Ruth's 1948 earnings were 1.5 times, or 150% of, her 1947 earnings. Why?

3. $1\frac{1}{2}$ or 1.5 times anything equals __% of it.

4. $1\frac{1}{2}$ = 1.__ = __%.

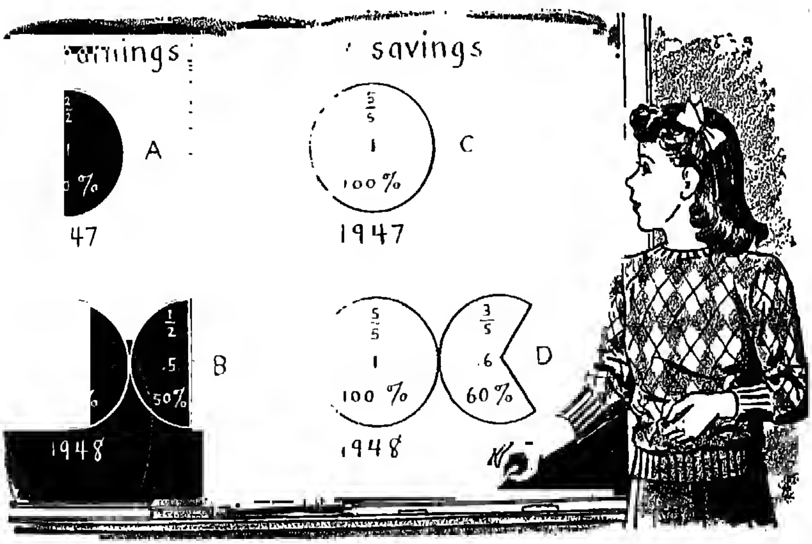
5. Ruth next drew the circle in Diagram C to represent all of her savings in 1947. Her 1947 savings may also be represented by $\frac{5}{5}$, by 1, or by __%.

6. Diagram D shows how her 1948 savings compared with her 1947 savings. Her 1948 savings were __ times her 1947 savings.

7. How does Diagram D show that Ruth's 1948 savings were 160% of her 1947 savings?

8. $1\frac{3}{5}$ or 1.6 times anything equals __% of it.

9. $1\frac{3}{5}$ = 1.__ = __%.



10. 2 times anything equals 200% of it. Make a diagram showing that 2 times anything = 200% of it.

11. $3\frac{1}{4}$ or 3.25 times anything equals 325% of it. Make a diagram showing that $3\frac{1}{4} = 3.25 = 325\%$.

12. $1\frac{1}{3}$ or $1.33\frac{1}{3}$ times anything equals $133\frac{1}{3}\%$ of it. Make a diagram showing that $1\frac{1}{3} = 1.33\frac{1}{3} = 133\frac{1}{3}\%$.

To change $4\frac{3}{4}$ to a decimal, first change the fraction part to a decimal. $\frac{3}{4} = .75$. So $4\frac{3}{4} = 4.75$. $1\frac{1}{4} = 1.25$. $2\frac{3}{10} = 2.3$. $7\frac{5}{6} = 7.83\frac{1}{3}$. $9\frac{1}{5} = 9.2$.

13. Change each mixed number below to a decimal.

$1\frac{1}{2}$ $\quad 3\frac{9}{10}$ $\quad 11\frac{4}{5}$ $\quad 9\frac{2}{3}$ $\quad 6\frac{1}{6}$ $\quad 5\frac{7}{8}$ $\quad 15\frac{5}{8}$

To change a mixed number to a per cent, first write the number as a decimal. Then move the decimal point *two places* to the right and put the per cent sign at the right of the number. Sometimes you will have to add a zero before you can move the decimal point. $4\frac{3}{4} = 4.75 = 475\%$. $8\frac{2}{3} = 8.66\frac{2}{3} = 866\frac{2}{3}\%$. $1\frac{9}{10} = 1.9 = 190\%$.

14. Change each mixed number below to a per cent.

$1\frac{1}{4}$ $\quad 9\frac{1}{10}$ $\quad 7\frac{5}{6}$ $\quad 5\frac{2}{5}$ $\quad 2\frac{1}{3}$ $\quad 6\frac{3}{8}$ $\quad 4\frac{1}{6}$

To change a per cent like 175% to a decimal, first write 175 without the per cent sign. Begin at the right and count off two places to the left. Put a decimal point there. Study the three examples that follow: $225\% = 2.25$. $133\frac{1}{3}\% = 1.33\frac{1}{3}$. $300\% = 3.00$, or 3.

15. Change each per cent below to a decimal.

525% $\quad 266\frac{2}{3}\%$ $\quad 115\%$ $\quad 900\%$ $\quad 313\frac{5}{6}\%$ $\quad 400\%$

16. Change each of the following to a per cent.

$\frac{4}{25}$ $\quad 2.18$ $\quad .06\frac{1}{3}$ $\quad 1\frac{3}{8}$ $\quad 75$ $\quad 3.7$ $\quad \frac{9}{40}$

Problems Using Per Cents

1. On Tuesday Bob earned \$1.25. On Thursday he earned 200% of this amount. Did he earn half as much or twice as much on Thursday as he earned on Tuesday?

2. The Hydes spend 30% of a \$2000 income for food. The Kents spend 20% of a \$4000 income for food. How much money does each family spend for food?

3. Compare the amount that the Kent family spends for food with the amount that the Hyde family spends.

4. Why is the following statement wrong? Since the Hydes spend 30% and the Kents spend 20%, the Hydes spend $1\frac{1}{2}$ times as much for food as the Kents.

5. Would it be correct to say that the Hydes spend $1\frac{1}{2}$ times as large a part of their income for food as the Kents?

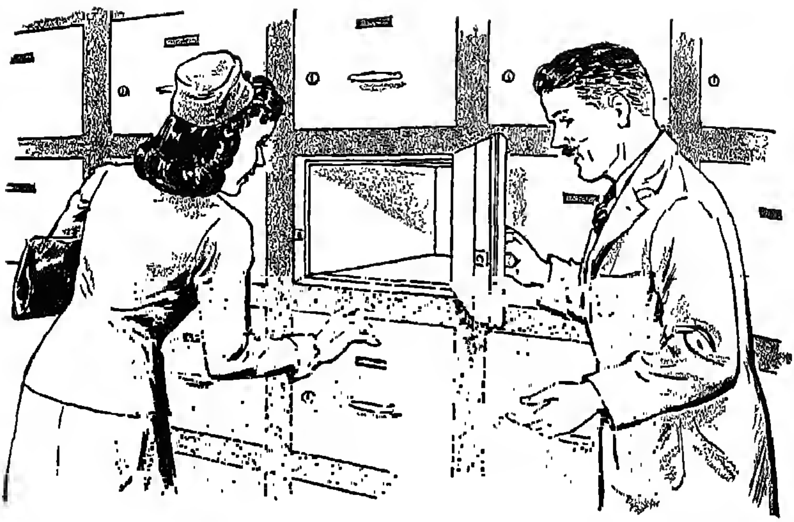
6. Is 150% of \$100 more than or less than 125% of \$100?

7. Line *A* is 4 centimeters long. Line *B* is 6 centimeters long. Is it correct to say that line *A* is $66\frac{2}{3}\%$ as long as line *B*? That line *B* is 150% as long as line *A*?

8. Mr. Brent is a salesman. His sales in July were 125% of his sales in June. Were his July sales higher or lower than his June sales?

9. Mr. Brent's August sales were 95% of his June sales. In which of the three months were his sales the highest? In which month were they the lowest?

10. A kilogram is about 2.2 lb. How do you know that 1 kilogram is about 220% of 1 pound?



Per Cents Larger than 100%

When Mrs. Carlson went to rent a frozen-food locker, the manager showed her a small locker that would hold 150 lb. of meat. He said he had a larger locker that would hold $133\frac{1}{3}\%$ as much as the first locker. How many pounds of meat would this larger locker hold?

Example A shows how to find $133\frac{1}{3}\%$ of 150.

First change $133\frac{1}{3}\%$ to a decimal. Does $133\frac{1}{3}\%$ equal $1.33\frac{1}{3}$?

Then multiply 150 by $1.33\frac{1}{3}$. Is 200.00 correct?

The larger locker would hold __ lb.

$133\frac{1}{3}\% = 1\frac{1}{3}$. Why? Will $1\frac{1}{3}$ times 150 lb. give you the number of pounds the locker would hold? Try it and see.

A

$133\frac{1}{3}\%$ of $150 =$

$1.33\frac{1}{3} \times 150 = 200$

$$\begin{array}{r} 150 \\ \underline{1.33\frac{1}{3}} \\ 450 \\ 450 \\ \underline{150} \\ 199\,50 \\ \underline{50} \\ 200.00 \end{array}$$

1. 225% of \$18 is \$__.

Look at Example B. Why do you multiply by 2.25?

Multiply \$18 by 2.25 to see if \$40.50 is the correct answer.

225% of \$18 is \$__.

B
225 % of \$18 =
2.25 × \$18 = \$40.50

2. What mixed number is equal to 225%? How can you use this mixed number to find 225% of \$18? Which is easier, to use the mixed number or to use 2.25 when you are finding 225% of \$18?

Check your work for Problems 3, 4, and 5 below by using Self-Help Examples C, D, and E.

3. Ten years ago the Harris School had 216 pupils. Now the number of pupils is 200% of the number ten years ago. How many pupils are there now?

Why do you multiply by 2.00 in Problem 3? Is multiplying by 2.00 the same as multiplying by 2? Why?

4. Jim is 4 ft. tall. His father said, "My height is exactly 150% of your height, Jim." Jim's father is how many feet tall?

What mixed number can you use to solve Problem 4?

5. Mrs. Burt said that her food expenses in 1944 were 125% of what they were in 1943. In 1943 she spent \$825 for food. How much did she spend for food in 1944?

C	D	E
200% of 216 pupils =	150 % of 4 ft. =	125 % of \$825 =
2.00 × 216 pupils =	1.5 × 4 ft. =	1.25 × \$825 =
432 pupils	6 ft.	\$1031.25

6. $116\frac{2}{3}\%$ of a number = ___ times the number.
7. 1000% of a number = ___ times the number.
8. 650% of a number = ___ times the number.
9. 100% of a number = ___ times the number.
10. 1.75 times a number = ___% of the number.
11. 7 times a number = ___% of the number.
12. $5\frac{1}{4}$ times a number = ___% of the number.

Problems Using Large Per Cents

1. Last year Mr. Hoyt harvested 2000 bu. of wheat. This year he expects to harvest 125% of last year's crop. This year he expects to harvest ___ bushels of wheat.

2. Mrs. Rouse sold 3000 doz. eggs last year. This year she hopes to sell $166\frac{2}{3}\%$ of that number. How many dozen eggs does she hope to sell this year?

3. If this year she sells only 95% of the eggs she sold last year, how many dozen eggs will she sell?

4. The population of the town of Bluff Falls was 3700 in 1944. An article in the paper said: "If Bluff Falls keeps on growing at its present rate, its 1950 population should be 150% of its 1944 population." According to this, what should be the town's population in 1950?

5. Ten years ago Mr. Burt bought a lot for $850. The lot now is worth 200% of what he paid for it. How much is it worth now?

When you find a per cent of a number, if the per cent is larger than 100%, your answer should be larger than the number. If the per cent is less than 100%, your answer should be smaller than the number.

6. One week Roy earned \$1.25. His older brother Bill said that he had earned 220% of that amount. If Bill was right, how much had he earned?

7. Why is \$27.50 a foolish answer for Problem 6?

8. There are three wage earners in the Carey family. Ann Carey earns \$105 per month. Her brother Fred earns 160% of the amount Ann earns. Her father earns 300% of the amount she earns. How much do the three wage earners together earn per month?

One way to solve Problem 8 is first to find the amount each person earns per month. Then find the sum of these three amounts. What answer do you get by this method?

Another way to solve the problem is to think of Ann's earnings as 100%. Then find the sum of the three per cents. 100%+160%+300%=560%. 560% of \$105= \$__, or the earnings of the whole family.

Did you get the same answer both ways? Which is the easier way to solve the problem?

When you solve Problem 9, use the second method explained above.

9. In August Mr. Richardson earned \$160. He earned 105% of this amount in September, 115% in October, 130% in November, and 80% in December. How much did he earn during all five months?

Use both methods to solve Problem 10 below. Are both answers the same?

10. Jane Hardy compared her savings with her brother's by saying that her savings were 125% of his. Her brother's savings amounted to \$40. How much were their total savings?

Per Cents Less than 1%

Mr. Adams received a 50-dollar bill in his pay envelope. To get it changed, he went to a place called a "currency exchange." The charge for changing it was $\frac{1}{2}\%$. How much did it cost Mr. Adams to get the bill changed?

Example A shows how to find $\frac{1}{2}\%$ of \$50. First find 1% of \$50. Why do you multiply by .01?

$.01 \times \$50 = \$.50$. What happens to the decimal point when you multiply a number by .01?

$\frac{1}{2}\% = \frac{1}{2}$ of 1%; so next find $\frac{1}{2}$ of \$.50. $\frac{1}{2}$ of \$.50 = \$.__.

A

$\frac{1}{2}\%$ of \$50 =

$\frac{1}{2}$ of 1% of \$50

1% of \$50 =

$.01 \times \$50 = \$.50$

$\frac{1}{2}$ of \$.50 = \$.25

Be prepared to explain why \$.25 is a reasonable answer for $\frac{1}{2}\%$ of \$50.

1. Mr. Moore's share of the commission for selling \$5000 worth of goods was $\frac{7}{8}\%$ of the sale price. How much was his commission?

Look at Example B.

First find 1% of \$5000. 1% of \$5000 = \$__.

Why do you next find $\frac{7}{8}$ of \$50?

How do you get the \$43.75?

Is \$43.75 a reasonable answer for $\frac{7}{8}\%$ of \$5000? Why?

B

$\frac{7}{8}\%$ of \$5000 =

$\frac{7}{8}$ of 1% of \$5000

1% of \$5000 =

$.01 \times \$5000 = \$50$

$\frac{7}{8}$ of \$50 = \$43.75

When you work with small per cents like $\frac{1}{2}\%$, $\frac{3}{4}\%$, $\frac{7}{8}\%$, $\frac{2}{5}\%$, or $\frac{9}{10}\%$, remember that such per cents are less than 1%. Always think about the size of your answer to be sure that it is reasonable.

Check your work for Problems 2, 3, and 4 below by using Self-Help Examples C, D, and E.

2. Mr. Hudson sold \$10,000 worth of goods at a commission of $\frac{3}{5}$%. What was the amount of his commission?

Why would \$600 be an unreasonable answer for Problem 2?

3. The Ross Collection Agency charges a service fee of $\frac{1}{2}$% on bills that it fails to collect. Find the service fee on an uncollectible bill for \$820.

4. A man weighing 150 lb. needs to eat enough calcium each year to equal about $\frac{2}{5}$% of his body weight. About how much calcium does he need to eat each year?

Why should the answer for Problem 4 be less than 1.5 lb.?

C	D	E
$\frac{3}{5}$% of \$10,000 =	$\frac{1}{2}$% of \$820 =	$\frac{2}{5}$% of 150 lb. =
$\frac{3}{5}$ of 1% of \$10,000	$\frac{1}{2}$ of 1% of \$820	$\frac{2}{5}$ of 1% of 150 lb.
1% of \$10,000 =	1% of \$820 =	1% of 150 lb. =
.01 × \$10,000 = \$100	.01 × \$820 = \$8.20	.01 × 150 lb. = 1.5 lb.
$\frac{3}{5}$ of \$100 = \$60	$\frac{1}{2}$ of \$8.20 = \$4.10	$\frac{2}{5}$ of 1.5 lb. = .6 lb.

If you want to, you can use decimals when you are working with per cents less than 1%. To change $\frac{1}{2}$% to a decimal, think of $\frac{1}{2}$% as $\frac{1}{2}$ of .01, or $.01 \div 2$, or .005. $\frac{3}{4}\% = \frac{3}{4}$ of $.01 = \frac{3}{4} \times .01 = .03 \div 4 = .0075$.

5. Change each per cent below to a decimal.

$\frac{1}{4}\%$ $\frac{1}{5}\%$ $\frac{2}{5}\%$ $\frac{3}{5}\%$ $\frac{4}{5}\%$ $\frac{1}{10}\%$ $\frac{3}{10}\%$ $\frac{7}{10}\%$ $\frac{9}{10}\%$

6. You change $\frac{1}{6}\%$ to a decimal in the same way. $\frac{1}{6}\% = \frac{1}{6}$ of $.01 = .01 \div 6 = .0016\frac{2}{3}$. Why is this decimal hard to work with?

7. When you have $\frac{1}{3}\%$, $\frac{2}{3}\%$, $\frac{1}{6}\%$, or $\frac{5}{6}\%$ in your work, do not change them to decimals. Think of them as $\frac{1}{3}$ of 1%, $\frac{2}{3}$ of 1%, and so on. Think of a reason why you should do this.

8. A small factory figured that its employees could work a total of about 44,000 hours during a year, if there were no accidents. Accidents usually cause a loss of $\frac{3}{4}\%$ of the 44,000 hours. About how many hours are lost in a year because of accidents in this factory?

You can solve Problem 8 by multiplying 44,000 hours by .0075. Why?

9. Mr. James should have worked about 2200 hours during the year. He said that he lost about $\frac{7}{8}\%$ of his time because of illness. About how many hours did he lose for this reason?

10. In 1800 the population of the United States was about 5,300,000. About $\frac{1}{10}\%$ of the total population lived in the Indiana Territory. About how many persons lived in the Indiana Territory in 1800?

11. In 1941 the total cash farm income from crops in the United States was about \$4,794,000,000. The income from cranberries was about $\frac{1}{5}\%$ of this amount. About how many dollars came from cranberries?

Find each answer below to the nearest cent.

12.	$\frac{7}{8}\%$ of \$2006	$\frac{3}{8}\%$ of \$4100	$\frac{5}{8}\%$ of \$8000
13.	$\frac{1}{5}\%$ of \$1750	$\frac{1}{3}\%$ of \$565	$\frac{2}{3}\%$ of \$350
14.	$\frac{1}{6}\%$ of \$884	$\frac{3}{4}\%$ of \$7500	$\frac{3}{5}\%$ of \$144

Without Pencil

	A	B	C	D	E	F
1.	Find the average: 18, 0, 33.	16 19 5 20	$\frac{1}{2}$ long ton = ____ lb.	Multiply: 605 7	Subtract: $1\frac{2}{5}$ $\frac{1}{5}$	$\frac{1}{8}$ of 216 is ______.
2.	$315 \div 7$	Multiply: 5 gal. 3 qt. 5	Subtract: 16.75 .85	24 × 31	$\frac{2}{3}+\frac{1}{3}+\frac{1}{6}$	4 bu. = ____ qt.
3.	$\frac{125}{25}$ in simplest form is ______.	Subtract: 104 89	$2\frac{2}{5} \times \frac{5}{6}$	$.4\overline{).264}$	$\frac{3}{4}$% = what decimal?	.2 is what fraction of 2.2?
4.	$87\frac{1}{2}$% = what common fraction?	36 is how many times 24?	$52\overline{)209}$	Multiply: 24 $2\frac{1}{2}$	8 is ____ of 12.	2 meters = about ___ inches

Practice with Per Cents

Find each of the following.

	A	B	C
1.	20% of \$16.50	$87\frac{1}{2}$% of 210	75% of 1496
2.	$\frac{1}{5}$% of \$7500	175% of \$265	$\frac{7}{8}$% of \$6448
3.	60% of \$29.95	$\frac{1}{4}$% of 856	80% of \$165
4.	113% of \$145	22% of \$.89	$5\frac{1}{4}$% of \$2200
5.	$\frac{4}{5}$% of \$20,000	45% of \$4	$33\frac{1}{3}$% of 1000
6.	$16\frac{2}{3}$% of 198	200% of \$90	$\frac{3}{4}$% of \$1800
7.	40% of 5285	2% of \$1.69	150% of \$385
8.	10% of \$10.00	$12\frac{1}{2}$% of \$64	125% of 505
9.	$133\frac{1}{3}$% of \$1200	$\frac{1}{2}$% of \$3600	72% of 1740

Think before You Answer

1. Which is more, 20% of \$400 or 30% of \$250?

2. 50% of an amount of money is how many times 10% of the same amount of money?

3. 15% of an amount of money is what fraction of 45% of the same amount of money?

4. What other facts do you need to know before you can answer the following question? 18% of a certain amount of money is how many times as much as 9% of a different amount of money?

5. Is $.75 \times \$65$ equal to $\frac{3}{4}$ of \$65 or to $\frac{3}{4}\%$ of \$65?

6. Is $.05 \times \$65$ equal to $\frac{1}{2}$ of \$65, to $\frac{1}{2}\%$ of \$65, or to 5% of \$65?

7. Is $.025 \times \$65$ equal to $\frac{1}{4}\%$ of \$65, to $2\frac{1}{2}\%$ of \$65, or to $\frac{1}{4}$ of \$65?

8. How is it possible for a family to spend 150% of its income during one year?

9. Is it possible to cut a cake so that the pieces will add up to 125% of the cake? Explain your answer.

10. Is it possible to earn 150% of the amount you expect to earn? Explain your answer.

11. Is it possible to get correct answers for 110% of the problems in a test? Explain your answer.

12. Is it possible to get correct answers for 10 problems in one test and 200% of that number of correct answers in another test? Explain your answer.

13. Is it possible to work 5 days in one week and 180% of that number in the next week? Why?

Learning through Practice

1.

$\frac{1}{4}$	53	$\frac{5}{6}$	$\frac{3}{5}$	.80	8.97	\$ 6.04	6.14
$\frac{3}{8}$	89	$1\frac{2}{3}$	$\frac{3}{4}$	.31	.98	58.98	3.02
$\frac{1}{2}$	97	$13\frac{3}{4}$	$\frac{1}{2}$	.05	5.06	42.86	2.93
$\frac{5}{8}$	61	$\frac{1}{3}$	$\frac{4}{5}$	.19	7.26	83.51	6.77
	35						

Multiply:

2.

\$98.15	654	9072	\$1483.60	\$74.00
8.05	$694\frac{1}{4}$	39	7	$61\frac{1}{4}$

3. $84\frac{2}{3}\times 39$ $\qquad \frac{1}{4}\times 3\frac{1}{5}$ $\qquad 80\times 61\frac{3}{4}$ $\qquad 3\frac{7}{10}\times 5\frac{5}{6}$

4. $\frac{7}{12}\times 14$ $\qquad \frac{4}{5}\times\frac{7}{16}$ $\qquad 42\frac{3}{8}\times 74$ $\qquad 2\frac{5}{6}\times 12$

Subtract:

5.

190063	$329\frac{1}{5}$	$8\frac{1}{2}$	59.243	$25\frac{1}{12}$	976.00
39254	$48\frac{3}{4}$	$5\frac{1}{3}$	58.359	$14\frac{1}{3}$	187.56

6. $62.8\overline{)3648.68}$ $\qquad 56\overline{)6.104}$ $\qquad .037\overline{).2331}$ $\qquad 28\overline{)182}$

7. $1\frac{5}{16}\div 3\frac{3}{10}$ $\qquad 15\frac{3}{4}\div 4\frac{1}{5}$ $\qquad 7\frac{1}{10}\div\frac{2}{3}$ $\qquad \frac{1}{16}\div\frac{1}{10}$

8. $5\div 3\frac{3}{4}$ $\qquad 1\frac{1}{10}\div\frac{1}{10}$ $\qquad \frac{3}{8}\div 3$ $\qquad \frac{5}{12}\div\frac{2}{3}$

For each sale below find the amount of the commission.

9. \$85.60; rate, 5%
10. \$128.50; rate, 2%
11. \$30.00; rate, 35%
12. \$3.00; rate, 25%
13. \$9.80; rate, 20%
14. \$64.20; rate, 15%
15. \$7.50; rate, 40%
16. \$17.80; rate, 20%
17. \$198.50; rate, 6%
18. \$125.50; rate, 12%

Finding Increase and Decrease

1. In Picture 1, Ellen found the amount by which her allowance was increased. What did Harriet find?

2. How did Ellen find the 10¢?

3. To get the 60¢ in Picture 2, Ellen multiplied 50¢ by 1.20. Why? How could she have found the amount of the increase in her allowance?

4. In Picture 2, did Harriet find the amount of increase or the amount of her new allowance?

5. Be ready to explain the figuring that Harriet must have done to get the 84¢.

6. If you find the amount of a 10% increase on a \$2500 salary, should your answer be more or less than \$2500? Why? Would you use the method in Picture 1 or the method in Picture 2? Why?

7. If you find what a \$2500 salary amounts to after a 10% increase has been given, should your answer be more or less than \$2500? Why? What is the answer?

8. In Picture 3 below how did Harriet find what Ellen's allowance would be if it were decreased 20%?

9. Her answer is less than Ellen's present allowance of 50¢. Does this seem reasonable? Why?

10. Why did Ellen use 80% in Picture 4? What figuring did she do to get 40¢?

11. What figuring did Harriet do to get 56¢? Is her answer reasonable? Why?

12. If you find a 5% decrease on a $4000 salary, should your answer be more or less than $4000? Why? How would you find the amount of this decrease?

13. If you find what a $4000 salary amounts to after a 5% decrease, should your answer be more or less than $4000? Why? What is the answer?

14. Joe has been promised a 10% increase in pay. He now receives $.70 an hour. He will receive an increase of $.__ an hour.

15. His new hourly rate will be __% of $.70.

Problems about Increase and Decrease

1. Mr. Horan found this notice in his Dec. 1 pay envelope: "Beginning Jan. 1 you will receive a salary increase of 10%." Mr. Horan has been earning $45 per week. How much per week will he earn after Jan. 1?

Think of his new salary as 110% of his old salary. Why? 110% of $45 = $__.

2. Mr. Abbott, who works with Mr. Horan, has been earning $52.50 per week. How much will he be earning if he gets a 10% increase in salary?

3. Jane Lawlor's allowance was 50¢ per week. When she entered junior high school, her father increased her allowance by 120%. How much was her new allowance?

How do you know that Jane's new allowance was 220% of 50¢?

4. The Benson family's operating costs for 1947 amounted to $288. Mrs. Benson said that in 1948 their operating costs showed a decrease of $4\frac{1}{2}$%. How much did their operating costs amount to in 1948?

Were the Bensons' 1948 operating costs $104\frac{1}{2}$% or $95\frac{1}{2}$% of their 1947 operating costs?

5. Mr. Cary earned $164 in Commissions in October. His November commissions showed a drop of $12\frac{1}{2}$%. Find the amount of his November commissions.

Can you solve Problem 5 by finding $\frac{7}{8}$ of $164? Why?

6. This month Miss York earned only 83% as much as she earned last month. This month's earnings decreased what per cent from last month's earnings?

Think of last month's earnings as 100%. Why?

Problems of Many Kinds

A diagram of Mrs. Ross's kitchen, with all its dimensions, is shown below. Mrs. Ross is going to buy a special kind of washable wallpaper 4 ft. wide to put around the lower part of the three walls shown in the diagram. The width of the paper will be its height on the wall. The part of the kitchen not shown is occupied by cabinets.

1. The paper costs 45¢ a foot. Why is it sold by the foot instead of by the square foot or square yard? For each foot she buys, she will get ___ sq. ft.

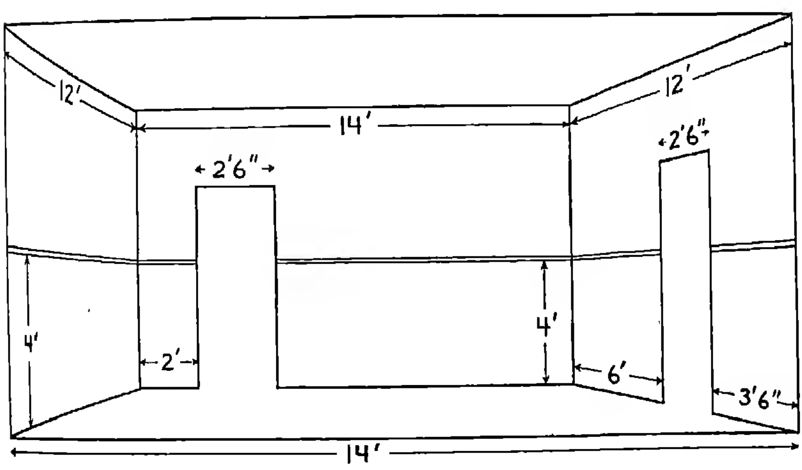
2. When Mrs. Ross finds how many feet of paper she needs, why should she subtract the widths of the doors?

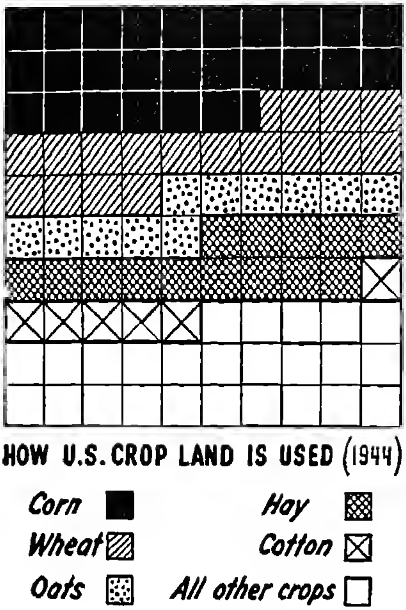
3. The ordering instructions say to add 9″ to the length of each wall for matching. Should Mrs. Ross add $2\frac{1}{4}'$ or 3′ to the number of feet she will need? Why?

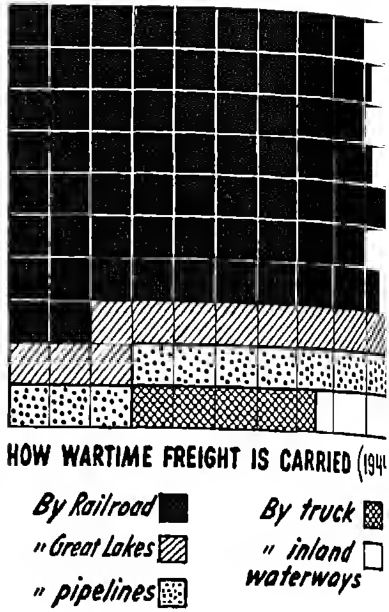
4. How many feet of paper will she need?

5. Should Mrs. Ross order the paper to the *nearest* whole foot or to the *next* whole foot? Why?

6. How much will the paper cost?







7. The left-hand graph above represents all, or __%, of the crop land in the United States in 1944. The key below the graph tells you how this crop land was used.

8. How many small squares are in the graph? Each small square represents __% of the crop land.

9. How many squares show the part of the crop land used for corn? __% of the crop land was used for corn.

10. Make a table showing what per cent of the crop land was used for corn, wheat, oats, hay, cotton, and all other crops.

11. Why can you tell just by looking at the graph that more acres were planted in corn than in any other crop? How does your table tell you the same thing?

12. Is it possible to tell from the graph whether more bushels of corn than of wheat were grown? Why?

13. Does the graph show whether or not the largest part of farm income came from corn? Why?

14. Make a bar graph showing how the crop land was used in 1944.

15. The right-hand graph on page 186 shows what per cent of wartime freight?

16. What per cent of all wartime freight was carried by railroads? On the Great Lakes? By pipelines? By trucks? By inland waterways?

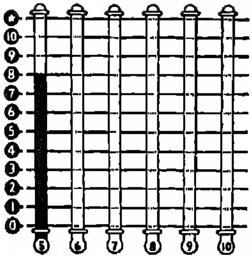
17. Arrange the per cents you found for Problem 16 in a table.

18. How can you show these per cents on a graph different from that on page 186? Make such a graph.

19. Next year Mr. Jenkins wants to grow enough corn so that he will not need to buy any feed corn for his 500 hens. He figures that each hen will need about 12 lb. of corn per year. He also figures on an average yield of 30 bu. of corn to the acre. About how many acres of corn will he need for his chicken feed? Figure the weight of 1 bu. of corn as 60 lb.

20. George read a newspaper statement saying that in 1944 the amount of money spent for food per capita in the United States was about 188% of the amount per capita in 1940. "Per capita" means "per person." The amount spent per capita in 1940 was $119. If the newspaper statement is true, about what was the amount spent per capita in the United States in 1944?

21. Could the statement in Problem 20 mean that each person in the United States ate more food in 1944 than in 1940? What else could it mean?



Self-Testing Drill 6

You will have exactly *20 minutes* for this drill. If you finish before the time is up, try "A Side-Trip in Mathematics" on page 189.

1. 6280
351
8231
1535
8435

2. Write on your paper the number that belongs where each question mark is below.

	FRACTION	DECIMAL	PER CENT
a	$\frac{1}{4}$	.25	?
b	?	.75	75 %
c	$\frac{4}{4}$, or 1	1.00	?

3. Subtract:
158063.1
60935.7

4. What is 1% of 1673?

5. Find the difference between 1,282,270 and 373,435.

6. Add these numbers: $2\frac{2}{3}$, $\frac{1}{2}$, $3\frac{7}{12}$.

7. $837\overline{)790.965}$

8. Change each of the following to a mixed number.
(*a*) $\frac{26}{3}$ (*b*) $\frac{11}{5}$ (*c*) $\frac{20}{6}$

9. Multiply:
534
651

10. 3 bu. 1 pk.
4 bu. 3 pk.
1 bu. 2 pk.

11. Multiply:
1.827
407

12. What is 7% of \$985?

13. $3\frac{1}{3} \div 2\frac{2}{5} =$

14. Divide 19.468 by 3.14.

15. Write each number below as a per cent.
(*a*) .5 (*b*) 1 (*c*) 1.5

16. (*a*) 9 qt. = __ gal. __ qt. (*b*) 18 gal. = __ qt.

17. Find the average:

$$\begin{array}{r} .665 \\ .762 \\ .725 \\ .754 \\ \underline{.129} \end{array}$$

18. Divide 6 gal. 1 qt. by 4.

19. $4.4308 \div 83.6 =$

20. $8\frac{1}{4} \times 6\frac{3}{4} =$

Examples 2, 8, 15, and 16 are wrong if any part is wrong.

Standards for Self-Testing Drill 6

Number Correct	0	1–4	5–6	7–8	9	10	11	12–13	14	15–16	17–19	20
Rating	0	1	2	3	4	5	6	7	8	9	10	★

A Side-Trip in Mathematics

In the Side-Trip on page 163 you learned an easy way to add two fractions with 1 for each numerator. There is also an easy way to subtract fractions with 1 for each numerator.

1. To subtract $\frac{1}{8}$ from $\frac{1}{4}$, first subtract the smaller denominator from the larger. $8-4=4$. This 4 is the new numerator. Then multiply the two denominators. $4 \times 8 = 32$. This 32 is the new denominator. Why should you next change $\frac{4}{32}$ to $\frac{1}{8}$? $\frac{1}{4}-\frac{1}{8}=$ __.

2. To subtract $\frac{1}{12}$ from $\frac{1}{5}$ by this method, first subtract _ from __. Then multiply __ by __. $\frac{1}{5}-\frac{1}{12}=$ __.

Do the examples below in your head and write down your answers. Then subtract in the usual way to check the answers you found.

3. $\frac{1}{6}-\frac{1}{8}$	6. $\frac{1}{3}-\frac{1}{8}$	9. $\frac{1}{5}-\frac{1}{10}$	12. $\frac{1}{2}-\frac{1}{3}$
4. $\frac{1}{2}-\frac{1}{10}$	7. $\frac{1}{2}-\frac{1}{5}$	10. $\frac{1}{4}-\frac{1}{5}$	13. $\frac{1}{3}-\frac{1}{10}$
5. $\frac{1}{3}-\frac{1}{5}$	8. $\frac{1}{4}-\frac{1}{10}$	11. $\frac{1}{8}-\frac{1}{12}$	14. $\frac{1}{4}-\frac{1}{6}$

Problems for Good Thinkers

1. Helen divided some cookies equally among herself and four friends. What per cent of the cookies did each receive?

2. George's room is 12 ft. wide. He told his sister that the length of his room is 125% of its width. From these two facts find the area of George's room.

3. Mrs. Allison's records show that she spends 12% of the family income for operating costs, twice that amount for shelter, and three times that amount for food. These three items total what per cent of the Allison family's income?

4. Of the remaining income Mrs. Allison spends $\frac{1}{4}$ for advancement and $\frac{1}{2}$ for clothing. She saves what is left. What per cent of the family income does she save?

5. Miss Mason's wages are $25 per week. Is it correct to say that she earns exactly $100 per month? If it is not correct, find her average monthly wages.

6. Mr. Holden's 1946 salary was $2400. He received a 10% increase in 1947. His salary was again increased by 10% in 1948. What was his 1947 salary? What was his 1948 salary?

7. Is it correct to say that Mr. Holden's 1948 salary was 120% of his 1946 salary? Why or why not?

8. Mr. Cobb's 1946 salary was $2400. He received no increase in 1947, but in 1948 he was given a 20% increase. You can tell without figuring that his 1948 salary was less than Mr. Holden's. How can you tell this?

Checking Up

Before you begin the new work in Chapter 4, do the work on this page and the next page to check up on how well you remember what you have learned.

1. How many decimal places does it take to write *ten-thousandths?* To write *millionths?*
2. Which is larger, .0006 or .00059? .0004 or .0010?
3. Write *17 billion 100 thousand 40* in figures.
4. Compare 16 with 8; 12 with 36; $\frac{1}{8}$ with $\frac{1}{4}$.
5. Write 4 fractions that are equal to $\frac{3}{4}$.
6. Find the area of a square 8′ 7″ on each side.
7. Write the decimals and per cents that are equal to the fractions below.

   $\frac{3}{4}$ $\frac{1}{8}$ $\frac{1}{3}$ $\frac{3}{5}$ $\frac{7}{10}$ $\frac{2}{3}$ $\frac{1}{5}$ $\frac{1}{4}$ $\frac{5}{6}$
8. Why can you use .875 to find $87\frac{1}{2}\%$ of \$100?
9. Change 5%, $12\frac{1}{2}\%$, $\frac{1}{2}\%$, and 115% to decimals.
10. The distance around a rectangle is called its __.
11. The amount of surface a rectangle covers is called its __.
12. Find the amount of a 15% discount on a bill for \$56.40. Find the net amount of the bill.
13. The gross amount of a bill is \$8.16. The net amount is \$7.65. How can you find the amount of discount?
14. What common fraction can you use to find a $33\frac{1}{3}\%$ discount?
15. $116\frac{2}{3}\%$ of a number is __ times the number.
16. $2\frac{1}{4}$ times a number is __% of the number.
17. 10 times a number is __% of the number.

18. Compare 20% of \$15 with 10% of \$60.

19. Which is larger, .007% or $\frac{9}{10}$%?

20. Richard used .15 of his money to buy a bond for \$18.75. He had \$__ before he bought the bond.

21. Find $\frac{7}{10}$% of \$480. Find $\frac{3}{8}$% of \$1200.

22. The rate of commission on a sale of \$392 is $12\frac{1}{2}$%. What is the amount of commission?

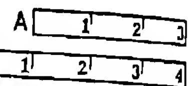
23. How do you know that the following budget will not work: wage deductions, 10%; life insurance, 2%; savings, 10%; operating costs, 7%; food, 27%; health, 5%; shelter, 23%; advancement, 8%; clothing, 13%?

24. Ruler A is __% as long as Ruler B.

25. __% of Circle C is black.

26. __% of Circle D is black.

27. \$.15 is __ of \$.18.



28. A man's savings this year amount to $116\frac{2}{3}$% of his savings last year. This is an increase of what per cent?

29. Tom gave away 24 stamps, which were $\frac{3}{4}$ of all the stamps he had bought. How many stamps had he bought?

30. Mr. Wilson has a rectangular field 80 rd. long and 30 rd. wide. How many acres are there in the field?

31. 3.5 T. = __ lb.

32. 5 A. = __ sq. rd.

33. 10 rd. = __ ft.

34. 10 sq. yd. = __ sq. ft.

Find the following.

35. $\frac{3}{4}$% of 800

36. 164% of 137

37. $\frac{5}{6}$ of \$138

38. $\frac{1}{2}$% of 450

39. $\frac{9}{10}$ of \$151.10

40. $116\frac{2}{3}$% of 600

CHAPTER 4

Taking Care of the Family's Savings

What Should Be Done with Savings?

The Howlands, like many families, have an income that is only a little more than their living expenses. By following their budget carefully, they are able to set aside part of their income for savings. In the picture they are deciding how to keep their savings.

These savings are very important to the Howlands because the money is being set aside for future needs. In later years they will need extra money to pay for the children's education, perhaps to buy a home, and to provide for emergencies. They also will need money to live on when Mr. Howland grows old and cannot work. Mr. Howland says, "Present saving means future security." What do you think he means?

Because their savings are so important, Mr. and Mrs. Howland want them kept safe. They also want this money to earn more money for them, if that is possible. One way this can be done is to deposit the money in a savings account in a bank, where it may earn a small rate of interest. In the bank it is safe from fire and theft and can be taken out when needed.

Another way the Howlands can make their money earn more money is to invest it. It may be used to buy shares in a business, to buy a house or a farm, or to loan to others. Money can be loaned to persons, to businesses, or to the government. Money invested in any of these ways will earn interest that can be added to the family's savings.

Mr. Howland knows that he must invest the family's savings carefully to avoid loss. He buys government bonds with most of the money he saves because he feels that such bonds are the safest investment he can make. For buying bonds he uses only the money that he feels reasonably sure he can do without for several years.

He also has a savings account in the bank, where he keeps the money that he thinks might be needed for sudden emergencies. He adds to this account from time to time. Sometimes, when he has not used any of this money for a long time, he withdraws part of it and uses it to buy government bonds. Why do you think he does this?

1. Should a person do without the things he really needs in order to save money? Why?

2. If you live in a town where there is no bank, what is a good way to take care of your savings?

3. How does a miser differ from a thrifty person?

4. If you were lending some of your savings to someone, what would you want to know about that person? Why?

5. Is it a good plan to lend all of your savings to one person? Why?

6. Is it a good plan to invest all of your savings in government bonds, just because they are the safest investment possible? Explain your answer.

7. Why might it not be a good plan to keep all of your savings in a savings account?

8. Most banks have boxes for rent called "safety deposit boxes" in which you can keep valuable papers, jewelry, and so on. Is it a good plan to keep money that you save in one of these boxes? Why or why not?

9. Give two good reasons for not keeping large amounts of money in the house or in your pocketbook.

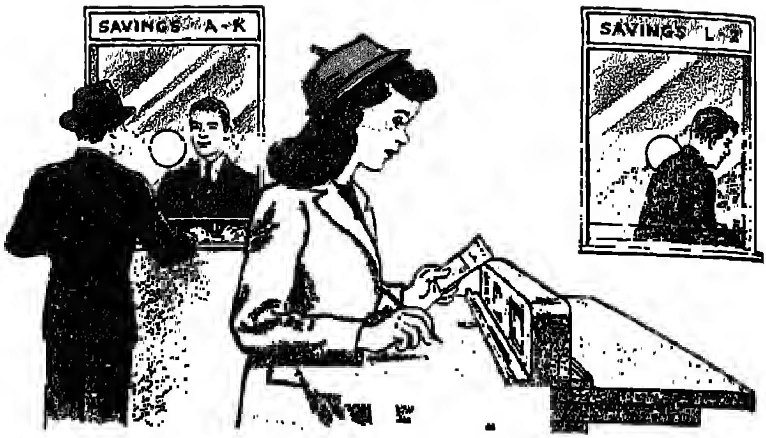
10. When you use money to buy a home, are you really spending the money or investing it? Why?

11. Which is more important, to invest money safely or to invest it so it will earn large amounts of interest? Give the reasons for your answer.

12. Two good reasons for saving and investing money are to provide a living in old age and to take care of emergencies. What other good reasons can you think of?

13. How is life insurance a way of investing savings? Before you answer this question, talk to someone who knows about life insurance.

14. For what purposes might you save money now?



Savings Accounts

Jean Harding saved \$2.87 and put it in her savings account at the bank. She *deposited* \$2.87 in her account. In the picture above, Jean is writing her name, the date, and the amount of money on a printed slip of paper called a *deposit slip*, shown in the picture below.

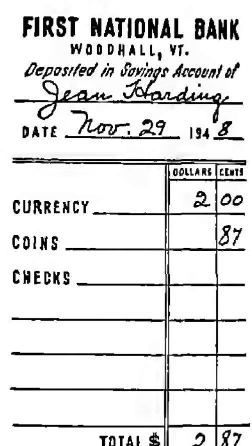
1. In what bank does Jean have her savings account?

2. She deposited the \$2.87 on what date?

3. Jean had 2 one-dollar bills; so she put a 2 in the dollars' column opposite the word *Currency*. Currency means bills, or paper money. Why did she write "00" in the cents' column?

4. Why did Jean write "87" in the cents' column opposite *Coins?*

5. Did she write the correct amount opposite *Total?*



FIRST NATIONAL BANK
WOODHALL, VT.
Deposited in Savings Account of
Jean Harding
DATE Nov. 29 1948

	DOLLARS	CENTS
CURRENCY	2	00
COINS		87
CHECKS		
TOTAL \$	2	87

Jean gave her money, her deposit slip, and her bankbook to the *teller.* He counted Jean's money, checked her deposit slip to see that it was correct, and wrote the amount of the deposit in her bankbook, as shown below.

6. The amount of money that Jean has in her account is called her *balance.* What was her balance after she had made this deposit of $2.87?

7. The first balance on the page is the balance *brought forward* from the page before. How much was brought forward when the page below was first used?

8. Each time the teller wrote a deposit in Jean's book, he added it to the balance she had before. What was her balance on May 3? On Aug. 31? On Sept. 25?

9. On July 3, Jean took out, or *withdrew,* $3.25. The amount she withdrew is called a *withdrawal.* Why did the teller subtract $3.25 from her balance on July 3?

10. On June 30, the bank paid Jean $1.32 for six months' use of her money. Money that is paid for the use of money is called *interest.* Why did the teller write this $1.32 interest in the column for deposits?

DATE		WITHDRAWALS	DEPOSITS	BALANCE
BROUGHT FORWARD				1 4 5 14
MAY	3		2 50	1 4 7 64
JUN	30	Interest	1 32	1 4 8 96
JUL	3	3 25		1 4 5 71
AUG	31		3 92	1 4 9 63
SEP	25		1 95	1 5 1 58
NOV	29		2 87	1 5 4 45

11. For each savings account below, write on your paper the dates shown. Then figure the balance for each date and write it opposite the date.

Account of *Marjorie Randall*

DATE		INITIALS	WITHDRAWALS	DEPOSITS	BALANCE
BROUGHT FORWARD					56.82
JAN	3 1948	m.R.		3.25	
FEB	3 1948	m.R.		2.00	
MAR	1 1948	m.R.		4.75	
APR	16 1948	m.R.	2.85		
MAY	11 1948	m.R.		5.38	
JUN	2 1948	m.R.		1.95	
JUN	30 1948	m.R.	Interest	.63	

Account of *Ann or Howard Drake*

DATE		WITHDRAWN	INTEREST	DEPOSITS	BALANCE
BROUGHT FORWARD					1357.64
JUL	9			125.00	
JUL	24	32.50			
AUG	16			55.17	
SEP	3	10.75			
OCT	2			8.44	
NOV	9			42.50	
DEC	1			218.00	
DEC	31		15.19		

Account of *Harry Anderson*

DATE		WITHDRAWN	DEPOSITS	BALANCE
BROUGHT FORWARD				295.85
DEC	14		15.25	
FEB	8		37.75	
APR	3		12.68	
MAY	1	Interest	3.12	
MAY	4	27.50		
MAY	29		5.00	

Bill Carson's Savings Account

1. When Bill Carson opened his cash bank, it contained \$3 in bills and \$2.29 in coins. He deposited this money in his savings account at the Kenton Bank on Oct. 16, 1947. How much did he deposit?

2. Make a deposit slip like the one Bill might have used. Then fill out the slip for his deposit.

Did you put the name of the bank, the date, and Bill's name on the slip? Why should you write \$3.00 opposite Currency? Where should you write \$2.29? \$5.29?

3. What should the teller have written in the date column in Bill's bankbook? In the deposits' column?

4. Before Bill made this deposit, he had a balance of \$53.92 in his account. What should the teller have written for Bill's new balance?

5. On Bill's next visit to the bank, he withdrew \$18.75 to buy a United States Savings Bond. Where should the teller have written this amount in Bill's bankbook? What should he have written in the balance column?

6. Bill made no more withdrawals before the end of the year. He did make three more deposits. They were for \$6.18, \$5.35, and \$8.72. What was his balance after each of these deposits?

7. On December 31 the bank put 45¢ interest into Bill's account. Should the teller have written the 45¢ as a deposit or as a withdrawal? Should he have added or subtracted?

8. How much money did Bill have in his savings account at the end of the year?

Finding Interest

Ann Todd put $200 into a savings account on Jan. 2. The teller said that on June 30 and Dec. 31 the bank would pay her interest on the money in her account. The *rate of interest* paid by the bank was 1% per year.

The amount of money on which a bank figures interest is called the *principal.* Ann's principal was $___.

Ann made no deposits and no withdrawals during the year, but on June 30 the bank added $1 interest to her account. On Dec. 31 the bank added $1.01.

Example A shows how to find the interest for June 30.

The interest for 1 year is 1% of the principal. So the interest for 1 year is 1% of $200, or $2.

By June 30 the $200 had been in the bank for only 6 mo. The interest due at that time amounted to $\frac{1}{2}$ of $2, or $1.

A

1% of $\$200 = \$2$

$6 \text{ mo.} = \frac{1}{2} \text{ yr.}$

$\frac{1}{2}$ of $\$2 = \$1$

$\$200 + \$1 = \$201$

Ann's new balance was $200+$1, or $___.

1. Study the work in Example B. It shows how to find the amount of interest Ann received on Dec. 31.

B
1% of \$201 = \$2.01
6 mo. = $\frac{1}{2}$ yr.
$\frac{1}{2}$ of \$2.01 = \$1.01
\$201 + \$1.01 = \$202.01

Why do you use \$201 for the principal this time?

What does 1% of the \$201 equal?

Next find $\frac{1}{2}$ of \$2.01. Why? Why is the answer \$1.01 instead of \$1.00?

How much interest did Ann receive on Dec. 31? To find her new balance, why do you add \$1.01 to \$201? Her new balance was \$__.

During the last six months of the year Ann received interest not only on the \$200 but also on the \$1 that she had received as interest for the first six months. When interest is added to the principal and then earns interest, the interest is said to be *compounded.* Ann's \$200 earned 1% *compound interest* that year.

After you have solved Problems 2, 3, and 4, compare your work with the work in Self-Help Examples C, D, and E on page 202. Correct any mistakes you made.

2. On April 1, Ann's father had \$464.38 in a savings account that pays interest at the rate of $1\frac{1}{2}\%$ per year. The interest is added to his account on March 31 and Sept. 30. Mr. Todd did not deposit or withdraw any money from April 1 to Sept. 30. Find his new balance after interest was added on Sept. 30.

Interest is usually figured on whole dollars only; so first find $1\frac{1}{2}\%$ of \$464. $1\frac{1}{2}\%$ of \$464 = \$__. Then find $\frac{1}{2}$ of \$6.96. Why?

Mr. Todd's new balance was \$464.38 + \$3.48. Why?

C	D.	E
$1\frac{1}{2}\%$ of \$464 = \$6.96	$1\frac{1}{2}\%$ of \$178 = \$2.67	$1\frac{1}{2}\%$ of \$179 = \$2.69
6 mo. = $\frac{1}{2}$ yr.	6 mo. = $\frac{1}{2}$ yr.	6 mo. = $\frac{1}{2}$ yr.
$\frac{1}{2}$ of \$6.96 = \$3.48	$\frac{1}{2}$ of \$2.67 = \$1.34	$\frac{1}{2}$ of \$2.69 = \$1.35
\$464.38 + \$3.48 = \$467.86	\$178 + \$1.34 = \$179.34	\$179.34 + \$1.35 = \$180.69

3. On Jan. 1, Mrs. Todd had \$178 in her account. She made no deposits or withdrawals during the year. Interest was added to the principal on June 30 and Dec. 31 at the rate of $1\frac{1}{2}\%$ per year. Find her new balance after the interest was added on June 30.

4. How much was Mrs. Todd's principal for the next six months? How much money did she have in her account after the interest had been added on Dec. 31?

5. Mrs. Anson had \$320 in her savings account on Jan. 1. Interest at the rate of 2% per year was added to her account on June 30 and Dec. 31. She made no deposits or withdrawals from Jan. 1 to June 30. How much interest was added to her account on June 30? What was her new balance then?

6. Mrs. Anson made no deposits or withdrawals from June 30 to Dec. 31. Find how much interest was added to her account on Dec. 31. Also find her new balance.

7. On June 30, Mr. Richardson deposited \$150 in a savings account that paid $2\frac{1}{2}\%$ interest June 30 and Dec. 31. If Mr. Richardson made no deposits or withdrawals before Dec. 31, how much interest should have been added to his account? What should have been his new balance then?

8. Mr. Fraser had $180.91 in his savings account on April 1. Six months' interest at the rate of $1\frac{1}{2}\%$ per year was added to his account on Sept. 30. Since Mr. Fraser had made no deposits or withdrawals, how much interest should have been added to his account on Sept. 30? His new balance should have been $__.

9. On Jan. 1, George had $48.37 in a savings account at a bank that paid interest on June 30 and Dec. 31 at the rate of 2% per year. What should have been his new balance on June 30 if he made no deposits or withdrawals before that date?

10. Find how much interest George's money should have earned from June 30 to Dec. 31 if he did not deposit or withdraw any money during that time. What should his new balance have been?

11. The interest for six months on a bank account of $340 at 2% per year is $__. What is the new balance?

12. What is the interest for six months on a bank account of $98.36 at $2\frac{1}{2}\%$? The new balance is $__.

13. The interest for six months on a bank account of $5000 at $1\frac{1}{2}\%$ is $__. The new balance is $__.

14. Find the interest for six months on a bank account of $126.35 at $2\frac{1}{2}\%$. The new balance is $__.

Find the interest for six months on each principal given below. Also find the new balance for each one.

	A	B	C
15.	$560 at 2%	$880 at 3%	$4634 at $2\frac{1}{2}\%$
16.	$74.50 at 2%	$1260 at $2\frac{1}{2}\%$	$44.10 at 2%
17.	$700 at $2\frac{1}{2}\%$	$14.50 at 2%	$65.40 at 3%
18.	$28.00 at 3%	$800 at $1\frac{1}{2}\%$	$130 at $1\frac{1}{2}\%$

Lending Money at Interest

In the picture below, John B. Hayes is borrowing \$350 from his friend David R. Martin. Mr. Hayes has agreed to pay back the \$350 in $1\frac{1}{2}$ years and to pay 5% interest per year for the use of the money.

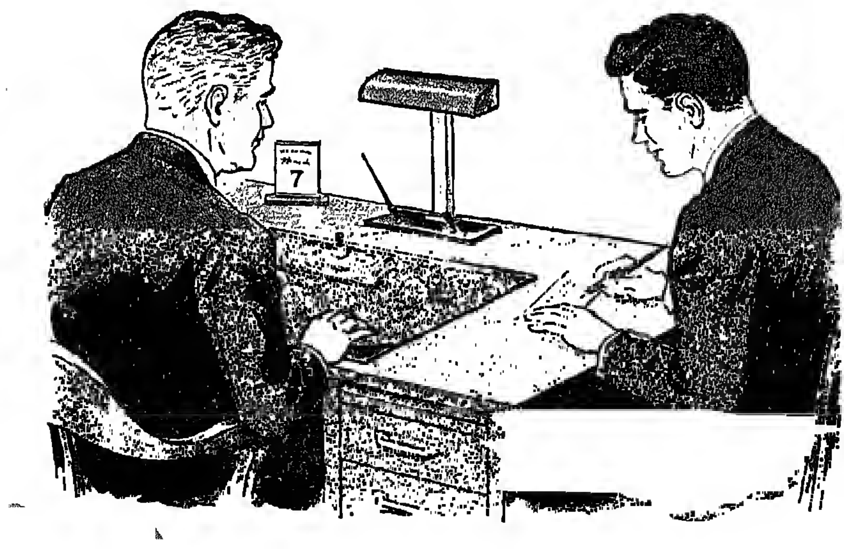
Mr. Hayes gave Mr. Martin the *promissory note* shown at the top of the next page. Then Mr. Martin gave Mr. Hayes \$350 in exchange for the note.

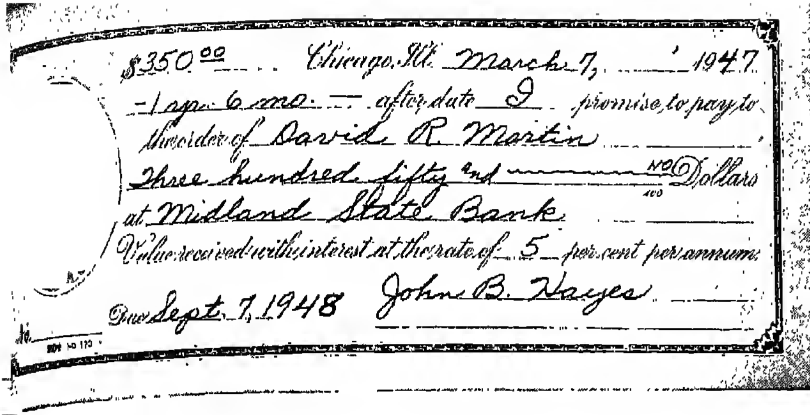
1. The words *per annum* mean per year. What part of the note shows that the interest rate was 5% per year?

2. The note is called a promissory note because it contains a promise to pay. What words on the note make the promise?

3. On what date was the note made out? When did it begin to earn interest? When was it due?

4. The amount of money that Mr. Martin lent to Mr. Hayes is called the *principal* of the note. The principal is shown on how many places on the note?





$350 00/100 Chicago, Ill. March 7, 1947
1 yr. 6 mo. after date I promise to pay to the order of David R. Martin
Three hundred fifty and no/100 Dollars
at Midland State Bank
Value received with interest at the rate of 5 per cent per annum
Due Sept. 7, 1948 John B. Hayes

5. Mr. Martin figured that the note would earn 5% of \$350, or \$__, in one year.

6. Since the note was made out for $1\frac{1}{2}$ yr., it would earn $1\frac{1}{2} \times$ \$17.50, or \$__, during that time. Interest on notes is not compounded.

7. Mr. Hayes paid the note on Sept. 7, 1948. At that time he gave Mr. Martin \$376.25. Why did he give Mr. Martin more money than he had borrowed?

8. If Mr. Martin had left this \$350 in his savings account, it would have earned \$10.61 compound interest at 2%. How much more interest did he get from the note than he would have received from this money if he had left it in his savings account?

9. Find the interest on a note for \$1230 for 6 mo. at 6% per year.

When you solve Problem 10, first find the interest for 1 yr. Why do you next multiply this amount by $2\frac{1}{2}$?

10. What is the interest on a promissory note for \$2800 for $2\frac{1}{2}$ yr. at $4\frac{1}{2}$%?

11. Find the interest on a promissory note for \$480 for $1\frac{1}{2}$ yr. at 5%.

Using a Formula to Find Interest

Miss Belden needed money to buy dresses to sell in her shop. So she went to the bank and borrowed \$650 for 4 mo. at 5% per year. How much interest did she have to pay?

1. The principal is \$__. The interest rate is __%. Why is the interest figured for $\frac{1}{3}$ yr.?

2. To find the interest for 1 yr., multiply the principal by __. The interest for 1 yr. is \$__.

3. The interest for $\frac{1}{3}$ yr. is $\frac{1}{3}$ of \$32.50. $\frac{1}{3}$ of \$32.50 is \$__. Should Miss Belden have paid \$10.83 or \$10.84?

When you found 5% interest on \$650 for 4 mo., you first multiplied the principal by the interest rate written as a decimal. Then you multiplied that answer by the time in years.

A short way to write what you did is shown above at the right. This *formula* means that *interest equals principal×rate×time in years.*

$$i = prt$$

$i=prt$ is another way of writing $i=p\times r\times t$.

A formula is a short and convenient way to write a rule that you are going to use over and over again.

4. Study Example A. It shows how to find by formula the interest on \$650 for 4 mo. at 5%.

You rewrite the formula with 650 in place of p, .05 in place of r, and $\frac{1}{3}$ in place of t. You do this because \$650 is the principal, .05 is the rate, and $\frac{1}{3}$ is the time in years.

A
$i = prt$
$i = 650 \times .05 \times \frac{1}{3}$
$i = 10.83\frac{1}{3}$, or \$10.83

Multiply to find what i equals. $650\times.05=32.50$. $32.50\times\frac{1}{3}=10.83\frac{1}{3}$. The answer is \$__.

5. Now use the formula to find $2\frac{1}{2}\%$ interest on \$2000 for $1\frac{1}{2}$ yr. Look at Example B. Why do you write 2000 in place of p? Why do you write .025 in place of r? Is it correct to write $1\frac{1}{2}$ in place of t? Why? What do you do next? What is the interest?

B
$i = prt$
$i = 2000 \times .025 \times 1\frac{1}{2}$
$i = \$75$

After you have solved Problems 6, 7, and 8 below, compare what you did with the work in Self-Help Examples C, D, and E. Correct any mistakes you made.

6. A promissory note for \$156 was made out for 3 mo. at an interest rate of $4\frac{1}{2}\%$. Use the interest formula to find the interest on this note.

In Problem 6 why do you use .045 for r?

7. How much interest would be earned by \$690 deposited for 6 mo. in a savings account paying $1\frac{1}{2}\%$?

8. Find the interest on a promissory note for \$1325 made out for 2 yr. 3 mo. at an interest rate of 6%.

Why do you use $2\frac{1}{4}$ for t in Problem 8?

C	D	E
$i = prt$	$i = prt$	$i = prt$
$i = 156 \times .045 \times \frac{1}{4}$	$i = 690 \times .015 \times \frac{1}{2}$	$i = 1325 \times .06 \times 2\frac{1}{4}$
$i = 1.75\frac{1}{2}$, or \$1.76	$i = 5.17\frac{1}{2}$, or \$5.18	$i = 178.87\frac{1}{2}$, or \$178.88

Use the formula to find interest on the following.

	A	B
9.	\$250 at 4% for 9 mo.	\$2000 at 2% for 6 mo.
10.	\$480 at $3\frac{1}{2}\%$ for $1\frac{1}{2}$ yr.	\$50 at $5\frac{1}{2}\%$ for 4 yr.
11.	\$675 at 5% for 18 mo.	\$2500 at $3\frac{1}{2}\%$ for 8 mo.

Problems from Grandfather Howe's Records

The following problems were made by Ruth Howe from some old business records that her grandfather showed her. Can you solve all of them?

1. An old note showed that in 1890 Mr. Howe had borrowed \$125 from Timothy Stone at 7% interest. On the back of the note were Mr. Stone's figures for the payment in full of the principal and interest at the end of one year. What should this total have been?

Problem 1 states that the interest is 7%. This means that the interest rate is 7% per year. Why is 1 used for t in solving the problem?

2. In 1894 Mr. Howe lent Josiah Brown \$160.75 at 8% interest for 21 months. How much interest should Mr. Howe have received at the end of 21 months?

Remember to change 21 mo. to years. 21 mo. = __ yr. Also remember that interest is not usually charged on parts of a dollar.

3. One of Mr. Howe's account books contained this statement: "$2\frac{3}{4}\%$ commission to Joseph W. Harms for selling 2680 lb. of wool at 32¢ a pound." What was the amount of this commission?

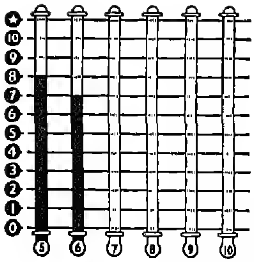
4. In 1893 a lawyer collected $900 principal and $50 interest on a loan that Mr. Howe had made. The lawyer charged a commission of $6\frac{1}{2}\%$ of the amount he collected. How much was his commission?

5. Did Mr. Howe lose money on this note? Why do you think so?

6. In 1891 Mr. Howe ordered $236.80 worth of farm equipment. He was given a discount of $12\frac{1}{2}\%$ because his order was for more than $100. What was the net amount of the bill for this equipment?

Learning through Practice

1. 9% of $7320 =
2. Divide 1846 by .26.
3. $\frac{4}{5}\%$ of $495 =
4. $64 \times 75 =$
5. $.096 \div 1.6 =$
6. 10% of $55.60 =
7. $\frac{4}{5}$ of $\frac{1}{6}$ is ___.
8. ___ of 81 is 9.
9. $\frac{2}{3}$ of ___ is 18.
10. Divide 259 by 1.4.
11. $.004 \times 18 =$
12. 500% of $240 =
13. Add $12\frac{7}{12}$ and $11\frac{11}{12}$.
14. Find $\frac{1}{8}\%$ of $1050.
15. Find $\frac{1}{4}\%$ of $1000.
16. $33\frac{1}{3}\%$ of $1500 =
17. $.87\frac{1}{2} \times 72$ bu. =
18. Divide 6.4 by 7.9.
19. 14% of $675 =$
20. $3.6918 \div 87.9 =$
21. Multiply .625 by 4.8.
22. $1\frac{3}{4} - \frac{5}{6} =$
23. Multiply 8016 by 52.
24. $811.52 − $613.66 =
25. 625 is ___ of 1125.
26. Divide 1.19 by 82.7.
27. $25 \times 31.8 =$
28. Multiply 438 by 397.
29. 1000% of $72 =
30. Divide .0952 by 4.76.



Self-Testing Drill 7

You will have exactly *20 minutes* for this drill. If you finish before the time is up, try "A Side-Trip in Mathematics" on page 212.

1. Subtract:
103639.79
61573.50

2. The difference between 17 and $9\frac{3}{4}$=

3. $\frac{5}{6}+2+1\frac{7}{8}+2\frac{1}{2}=$

4. Multiply:
2 lb. 4 oz.
4

5. Write on your paper the numbers that belong where the question marks are below.

6. Subtract:
910800
812284

	FRACTION	DECIMAL	PER CENT
a	$\frac{1}{2}$	?	50%
b	?	$.33\frac{1}{3}$	$33\frac{1}{3}$%
c	$\frac{5}{4}$, or $1\frac{1}{4}$	1.25	?

7. Divide 2 by $4\frac{1}{3}$.

8. Multiply $3\frac{1}{3}$ by $6\frac{3}{5}$.

9. Write the decimal fraction that is equal to each of the following per cents.

(*a*) 3% (*b*) $3\frac{1}{2}$% (*c*) $3\frac{3}{4}$%

10.
$98.71
49.38
75.00
82.99
6.00
61.99

11. What is 200% of 350?

12. Find a 9% discount on $931.

13. $540\overline{)4327}$

14. $8.7\times846.5=$

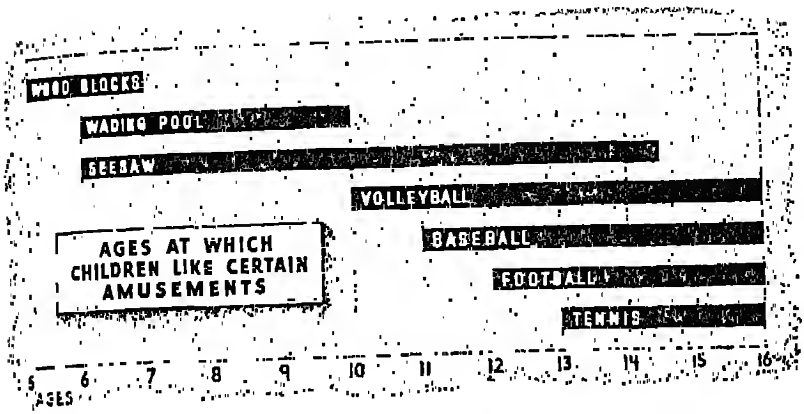
15. Divide 9 lb. 6 oz. by 8.

16. Find the answer for 9735 multiplied by 35.

17. Divide 28.1911 by 7.21.

18. Find $\frac{1}{2}\%$ of 723.

19. Mr. Jackson lent $176.00 to Mr. Cummings at 3% interest. How much interest will this loan earn in 2 years 6 months?



20. Use the graph above to answer these questions:
   (*a*) What games do children begin to like at the age of 6?
   (*b*) For about how many years is "seesaw" liked?
   (*c*) At what age do boys begin to like football?
   (*d*) At what age do children stop playing with wood blocks?

Examples 5, 9, and 20 are wrong if any parts of the examples are wrong.

Standards for Self-Testing Drill 7

Number Correct	0	1–3	4–5	6	7	8	9	10–11	12	13–14	15–19	20
Rating	0	1	2	3	4	5	6	7	8	9	10	★

Do not forget to fill in your Progress Chart. Do the thermometers show that your work on these drills is improving?

A Side-Trip in Mathematics

Multiplication has not always been done as we do it now. The method explained below was used many years ago to multiply two numbers, such as 46 and 35.

First write 46 and write the figure 1 beside it. This means that 1×46 is 46.

Next double the 46 and the 1. Write 92 and a 2. This means that 2×46 is 92.

Then double both the 92 and the 2. The 184 and the 4 mean that 4×46 is 184.

Keep on doubling in this way until you can pick out numbers on the right that add up to exactly 35.

46	1
92	2
184	4
368	8
736	16
1472	32

46	1
92	2
1472	32
1610	35

1, 2, and 32 add up to 35. So add 46, 92, and 1472 to find the answer for 35 times 46.

1. Multiply 46 by 35 in the usual way to see if 1610 is the correct answer.

2. To multiply 17 by 12 in this way, you write 17 and a 1; 34 and a 2; 68 and a 4; 136 and an 8. Which numbers do you add to get the answer? Why?

Find the answers for the examples below in the way just explained. Can you use this method to check your regular work in multiplication? Why or why not?

3. 7×6423	**6.** 24×91	**9.** 25×94	**12.** 42×115
4. 19×125	**7.** 48×76	**10.** 65×93	**13.** 31×684
5. 11×641	**8.** 31×52	**11.** 53×54	**14.** 129×215

Is this method or the usual one easier? Why?

Without Pencil

	A	B	C	D	E	F
1.	Fraction equivalent for $87\frac{1}{2}\%$ is ____.	Add: $12\frac{2}{3}$ $3\frac{1}{3}$	$10\overline{)2.70}$	$\frac{4}{5} \times \frac{1}{16}$	$13\overline{)40}$	400% of 5 is ____ × 5.
2.	2% of 8 = ____	5 sq. yd. = ____ sq. ft.	.055 = ____%	12 is ___ of 30.	Compare 14 with 21.	$\frac{9}{16} \div \frac{3}{4}$
3.	$9\frac{1}{3} \times \frac{3}{8}$	20% of \$400 = \$____	Perimeter of a $1\frac{1}{2}$ ft. square is ____.	Subtract: $23\frac{2}{3}$ $10\frac{1}{3}$	67 18 23 92	Multiply: 20.8 5
4.	$\frac{1}{2}$% of \$1 = ____¢	$\frac{3}{4}$% = what decimal?	Which is more, .051 or .006?	Find the average: 5, 0, 7, 4, 6, 8.	Subtract: \$1.87 1.15	$1\frac{3}{4} \div \frac{1}{8}$

Think before You Answer

1. May you always think of any whole number as having a decimal point? If so, where is the point?

2. How may you change a common fraction to an equal decimal fraction?

3. When you change a per cent to a decimal fraction, why do you move the decimal point to the left?

4. When you change a decimal fraction to a per cent, why do you move the decimal point to the right?

5. Is it correct to say that you can compare two numbers by dividing one of them by the other?

6. When you say that a number is 10% of another number, are you comparing the two numbers?

What must I find? Add? Multiply? Shall I subtract? Divide? Why? What numbers shall I use?

Problem Test 4

1. Mr. Kellogg bought a truck battery. It was a \$30 model, but he received a discount of 30%. What was the amount of the discount? (3)

2. During the four Saturdays in April, Jack Berry worked the following number of hours for Mr. Miller: $3\frac{1}{3}$ hr., $2\frac{1}{2}$ hr., $5\frac{1}{4}$ hr., and $4\frac{3}{4}$ hr. What was the total number of hours that Jack worked for Mr. Miller on these four Saturdays? (3)

3. On Monday the National Clothing Company put 1268 suits on sale. The sales by days were as follows: Monday, 74 suits; Tuesday, 136 suits; Wednesday, 86 suits; Thursday, 275 suits; Friday, 304 suits. The sale ended on Friday. How many of the 1268 suits were not sold by the time the sale ended? (4)

4. Mrs. Cummings bought $\frac{3}{4}$ of a yard of silk at \$2.40 a yard. She gave the clerk a \$5.00 bill to pay for it. How much change should she have received? (4)

5. Mr. Harris is buying some small shrubs that cost 90¢ apiece. If he buys a whole dozen for \$9.00, how much will he save on each shrub? (4)

6. The cash register records of the Broadway Cafe showed that the number of meals served in one week was as follows: Sunday, 345; Monday, 1307; Tuesday, 794; Wednesday, 983; Thursday, 606; Friday, 1360; and Saturday, 1286. Find the total number of meals served that week. (4)

7. On June 1, Alice weighed 85 lb. 4 oz. This was a gain of 2 lb. 11 oz. since January 1. How much did Alice weigh on January 1? *(4)*

8. At present the Citizens Bank is paying its bookkeepers $120 a month. Beginning next month their salaries will be increased 15%. What will be the monthly salary of the bookkeepers beginning next month? *(5)*

9. The Ross family left their home in Colorado on Monday at 10 A.M. to go on a vacation trip to Glacier National Park. They reached the park on Wednesday at 11:45 A.M. How long did the trip to the park take? *(6)*

10. Each of the bricks that Mr. Burke used for his sidewalk covered a surface 4 in. wide by 8 in. long. Without allowing for the spaces between the bricks, find how many bricks he should have bought for his sidewalk, which was 4 ft. wide and 15 ft. long. *(6)*

11. Mr. West borrowed $800 from a friend. At the end of 2 years 9 months he paid the principal and interest for the entire time of the note. The rate of interest was 6 per cent. How much money, including both principal and interest, did Mr. West pay? *(6)*

Standards for Problem Test 4

Poor	Fair	Average	Good	Excellent
0–10	11–20	21–32	33–43	44–49

Practice with Fractions

1. $3\frac{1}{8}-2\frac{1}{2}$	3. $\frac{3}{10}\div1\frac{1}{2}$	5. $\frac{3}{4}-\frac{3}{10}$	7. $6\frac{1}{4}+8\frac{7}{8}$
2. $3\frac{1}{3}\times\frac{5}{16}$	4. $\frac{3}{4}+\frac{5}{12}$	6. $2\frac{2}{5}\div6$	8. $7\frac{1}{6}\times9\frac{5}{12}$

Using Per Cents to Compare Numbers

You have learned how to use common and decimal fractions in three ways: to find a fraction of a number, to find what fraction one number is of another, and to find a number when you know a fraction of it.

1. $\frac{2}{3}$ of 36 is __. 24 is __ of 36. $\frac{2}{3}$ of a number is 24. The number is __.

2. .4 of 70 is __. 28 is .__ of 70. .4 of a number is 28. The number is __.

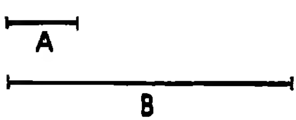
Whenever you find what fraction one number is of another, you are comparing the two numbers. You can also compare two numbers by finding what per cent one number is of the other.

3. Henry has $\frac{1}{2}$ as much money as Dick. Why can you say that Henry has .5 as much money as Dick? Why can you also say that Henry's money is 50% of Dick's money? 25¢ is __% of 50¢. 25 is __% of 50.


HENRY'S MONEY

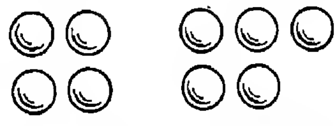

DICK'S MONEY

4. Dick has 2 times as much money as Henry. Why can you say that Dick's money is 200% of Henry's? 50¢ is 200% of 25¢. 50 is __% of 25.



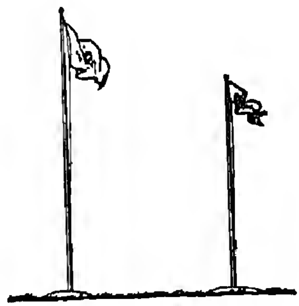
5. Line *A* is 1 centimeter long. Line *B* is 4 centimeters long. Line *A* is what fraction of line *B*? Line *A* is what decimal fraction of line *B*? Line *A* is what per cent of line *B*? 1 centimeter is __% of 4 centimeters. 1 is __% of 4.

6. Line B is __ times as long as line A. Why is line B 400% of line A? 4 centimeters is __% of 1 centimeter. 4 is __% of 1.



7. Jim's marbles are $\frac{4}{5}$, or .__, of Joe's marbles. Jim's marbles are __% of Joe's marbles. 4 is __% of 5.

8. Does Joe have $1\frac{1}{4}$ times as many marbles as Jim? Is it correct to say that Joe's marbles are 1.25 times Jim's? Why? Why are Joe's marbles 125% of Jim's? 5 is __% of 4.



9. The larger pole is 24 ft. tall, and the smaller pole is 18 ft. tall. The smaller pole is __, or .75, or __% as tall as the larger pole. 18 is __% of 24.

10. The larger pole is $1\frac{1}{3}$ times as tall as the smaller pole. The height of the larger pole is $133\frac{1}{3}$% of the height of the smaller pole. How do you know? 24 is __% of 18.

11. Can you say that 3 is 75% of 4? Why?

12. 4 is $1\frac{1}{3}$ times 3, or $1.33\frac{1}{3}$ times 3. 4 is what per cent of 3?

13. 1 is what fraction of 5? 1 is __% of 5.

14. 5 is how many times 1? 5 is __% of 1.

15. 2 is __, or .__, of 5. 2 is __% of 5.

16. 5 is __ times 2. How do you know that 5 is 250% of 2?

One Number Is What Per Cent of Another?

Last week Miss Young's total income was \$50. She saved \$6 of this income. What per cent of her income did she save last week?

To answer the question, you should find what per cent \$6 is of \$50. How do you know that the answer should be less than 100%? Now study the work below.

Think: "6 is what fraction of 50?" Miss Young saved $\frac{6}{50}$ of her income. Now change the fraction to a decimal.

To do this, divide the numerator of $\frac{6}{50}$ by the denominator. Divide 6 by 50. Is .12 correct?

A

\$6 is $\frac{6}{50}$ of \$50.

$\frac{6}{50} = 6 \div 50 = .12$

$.12 = 12\%$

To change .12 to a per cent, move the decimal point 2 places to the right and write the per cent sign.

Miss Young saved __% of her income last week.

When you find what per cent one number is of another, it will help to keep your thinking accurate if you first decide whether your answer should be more than 100% or less than 100%. Then decide which number should be the denominator of the fraction you will use.

In Problem 1 below, how do you know that your answer should be less than 100%? Should you use 3 or 15 for the denominator of the fraction? Why?

1. One week Bert earned \$15. He used \$3 of his earnings to buy books. What per cent of his earnings did he use to buy books?

B

$3 is $\frac{3}{15}$ of $15.

$\frac{3}{15} = 3 \div 15 = .2$

$.2 = 20\%$

Now study Example B. How is the .2 found? .2 is changed to 20%. Is this correct? Bert used _% of his earnings for books.

Solve Problems 2, 3, and 4. Then check your work with Self-Help Examples C, D, and E on page 220. Correct any mistakes in your work.

2. Jim misspelled 6 words on a spelling test of 75 words. What per cent of the words did he misspell?

Why should the answer for Problem 2 be less than 100%? You are to find what per cent 6 is of 75; so use _ for the denominator of the fraction.

3. Mr. Weston has \$900 invested in a coal mine. Last year this investment earned \$36. What per cent did Mr. Weston earn on his investment last year?

Should your answer for Problem 3 be more than or less than 100%? What number should you divide by?

C	D	E
6 words are $\frac{6}{75}$ of 75 words.	\$36 is $\frac{36}{900}$ of \$900.	\$11 is $\frac{11}{550}$ of \$550.
$\frac{6}{75} = 6 \div 75 = .08$	$\frac{36}{900} = 36 \div 900 = .04$	$\frac{11}{550} = 11 \div 550 = .02$
$.08 = 8\%$	$.04 = 4\%$	$.02 = 2\%$

4. On another investment of $550 Mr. Weston received $11 last year. What per cent did he earn on this investment?

5. $4 is what per cent of $80?

In Example 5 above why should you divide 4 by 80 instead of 80 by 4?

6. $120 is what per cent of $480?

7. $24 is __% of $40.

8. __% of $150 is $120.

9. 270 is __% of 300.

10. $225 is __% of $7500.

11. __% of $2400 is $600.

12. 16 is __% of 20.

13. 621 is __% of 828.

14. __% of 450 is 45.

15. 108 is __% of 720.

16. 52 is __% of 65.

17. __% of 396 is 99.

18. 15 is __% of 125.

Problems about Investments

1. Mr. Forbes borrowed $640 for one year. At the end of the year he paid back $640 plus $32 in interest. What was the rate of interest?

In Problem 1 you must find what per cent $32 is of $640. Should your answer be more than or less than 100%?

Which number do you use for the denominator? What do you do after you have written the correct fraction?

2. All salesmen for the Ajax Company have invested some of their savings in the company. One salesman has a total of $4200 invested. Last year this salesman received $252 from his investment. What per cent did he earn on his investment?

3. Mr. Brady put $320 of his savings in a savings account. He had $960 of his savings left, with which he bought government bonds and stamps. What per cent of his total savings did he put in the savings account?

In Problem 3 why is it incorrect to find what per cent $320 is of $960? It is also incorrect to find what per cent $960 is of $320. Why?

4. What per cent of his total savings did Mr. Brady invest in government bonds and stamps?

A short way to solve Problem 4 is first to think of Mr. Brady's total savings as 100%. What should you do next?

5. Mr. Jones lent Mr. Lee $600 for 1 year. At the end of the year Mr. Lee gave Mr. Jones $636 in payment of this loan. What was the rate of interest?

What must you be careful to do first in Problem 5?

6. Mr. Andrews made an investment of $450 that earned him $18 in 1 year. He made another investment of $320 that earned him $16 in 1 year. Which investment earned the larger per cent of interest?

7. Mrs. Burnham lent her cousin $250. At the end of 1 year her cousin paid her $260 for principal and 1 year's interest. What was the rate of interest?

How do you know without working Problem 7 that 96% is not a sensible answer?

Using Per Cents That Are Reasonable

A per cent like $47\frac{8}{15}\%$ is hard to work with; so you may sometimes "round it off" to the nearest whole per cent. $47\frac{8}{15}\%$ is 48% to the nearest whole per cent because $\frac{8}{15}$ is more than $\frac{1}{2}$. $15\frac{5}{18}\%$ is 15% to the nearest whole per cent because $\frac{5}{18}$ is less than $\frac{1}{2}$.

1. Round off each per cent in Row A below to the nearest whole per cent.

Row A $66\frac{8}{19}\%$ $38\frac{5}{12}\%$ $1\frac{11}{15}\%$ $84\frac{13}{14}\%$ $2\frac{15}{33}\%$

2. In more exact work with per cents you may have to round off a per cent to the nearest tenth of a per cent. To the nearest tenth of a per cent, $10.3\frac{25}{32}\%$ is 10.4% because $\frac{25}{32}$ is __ than $\frac{1}{2}$.

3. Round off each per cent in Row B below to the nearest tenth of a per cent.

Row B $65.4\frac{99}{107}\%$ $50.2\frac{9}{31}\%$ $11.0\frac{5}{11}\%$ $21.0\frac{34}{49}\%$

4. In Row C there are 5 per cents that are equal, or equivalent, to fractions you often use. These per cents are usually written with a common fraction instead of a decimal at the end. Write the fraction that is equivalent to each of these per cents.

Row C $33\frac{1}{3}\%$ $66\frac{2}{3}\%$ $16\frac{2}{3}\%$ $83\frac{1}{3}\%$ $87\frac{1}{2}\%$

5. The per cents in Row C are seldom rounded off to the nearest whole per cent because in working with these per cents it is usually more convenient to use their fraction equivalents. Why is it more convenient to use $\frac{1}{6}$ instead of $16\frac{2}{3}\%$ or $1\frac{7}{8}$ instead of $187\frac{1}{2}\%$?

6. Give the mixed number that you can use for:

Row D $216\frac{2}{3}\%$ $112\frac{1}{2}\%$ $366\frac{2}{3}\%$ $237\frac{1}{2}\%$ $133\frac{1}{3}\%$

Finding Mixed-Number Per Cents

Miss Rand had total savings of \$120. She used \$15 of her savings to pay a doctor's bill. What per cent of her savings did she use?

Find what per cent \$15 is of \$120. Should your answer be more or less than 100%? What should you use for the denominator of the fraction?

Divide 15 by 120, as in Example A. Do you get .125?

To change .125 to a per cent, first move the decimal point 2 places to the right. Then write the per cent sign.

A

\$15 is $\frac{15}{120}$ of \$120.

$$120\,\overline{)\,15.000}\quad = .125$$

```
        .125
120 ) 15.000
      12 0
       3 00
       2 40
         600
         600
```

$.125 = 12.5\%$, or $12\frac{1}{2}\%$

Why is it best not to round off $12\frac{1}{2}\%$ to 13%?

1. Last week Bill Hyde earned \$39 and spent \$26. What per cent of last week's earnings did Bill spend?

Your answer should be __ than 100%. What denominator should you use?

Divide 26 by 39, as in Example B. When you have divided to hundredths, you can see that no matter how far you divide, you will always have 26 for a remainder. How do you know this?

How do you get the $\frac{2}{3}$ in $.66\frac{2}{3}$? $.66\frac{2}{3}$ = __%.

Why should you not round off $66\frac{2}{3}\%$ to 67%?

B

\$26 is $\frac{26}{39}$ of \$39.

```
       .66 2/3
39 ) 26.00
     23 4
      2 60
      2 34
        26
```

$.66\frac{2}{3} = 66\frac{2}{3}\%$

2. Mr. Nash's salary is $51 per week. His friend Mr. Gregg has a salary of $65 per week. Mr. Nash's salary is what per cent of Mr. Gregg's salary?

Should the answer for Problem 2 be more than 100% or less than 100%? Why?

Look at Example C. Why is $\frac{51}{65}$ the correct fraction to use?

Is the division correct?

Why can you round off .784 to .785? How do you change .785 to a per cent?

How do you know that 78.5% is correct to the nearest tenth of a per cent?

C $51 is $\frac{51}{65}$ of $65.

$$\begin{array}{r} .78\cancel{4}^{5} \\ 65\overline{)51.000} \\ \underline{45\,5} \\ 5\,50 \\ \underline{5\,20} \\ 300 \\ \underline{260} \\ \cancel{40} \end{array}$$

.785 = 78.5%

In each of the following problems find the answer to the nearest tenth of a per cent, unless the answer is $12\frac{1}{2}\%$, $37\frac{1}{2}\%$, $62\frac{1}{2}\%$, $87\frac{1}{2}\%$, $33\frac{1}{3}\%$, $66\frac{2}{3}\%$, $16\frac{2}{3}\%$, or $83\frac{1}{3}\%$. Why should you usually not round off such per cents?

After you have solved Problems 3, 4, and 5, compare your work with Self-Help Examples D, E, and F on page 225. Correct any mistakes that you made.

3. Helen Collins used $400 of her $480 savings to buy bonds. What per cent of her savings did she use to buy bonds?

4. Mr. Evans has total savings of $805. He keeps $230 of his savings in a bank. What per cent of his total savings does he keep in the bank?

Why should your answer for Problem 4 be given as 28.6% instead of 28.5%?

D	E	F
\$400 is $\frac{400}{480}$ of \$480.	\$230 is $\frac{230}{805}$ of \$805.	\$21 is $\frac{21}{65}$ of \$65.
$\frac{400}{480} = 400 \div 480 = .83\frac{1}{3}$	$\frac{230}{805} = 230 \div 805 = .285\frac{575}{805}$, or .286	$\frac{21}{65} = 21 \div 65 = .323\frac{5}{65}$, or .323
$.83\frac{1}{3} = 83\frac{1}{3}\%$	.286 = 28.6%	.323 = 32.3%

5. During Christmas week Mr. Allison earned \$65. That week the Allison family spent \$21 for food. What per cent of their income did they spend for food?

6. Mr. Glenn earned \$104 in 2 weeks. He saved \$13 of this amount. What per cent did he save?

7. Out of a yearly income of \$2000 the Tyler family sets aside \$95 for dental expenses. This \$95 is what per cent of their yearly income?

8. Last week Jim earned \$2.00. He spent 55¢ of these earnings for school supplies. He spent __% of his earnings for school supplies.

Your work for Problem 8 may be easier if you change \$2.00 to cents before you divide. Why?

9. \$36 is what per cent of \$216?

Which is better, to give the answer for Example 9 as $16\frac{2}{3}\%$ or as 17%? Why?

10. __% of 96¢ is 60¢.

11. 17 is __% of 400.

12. \$13 is __% of \$286.

13. 189 is __% of 567.

14. __% of 80 is 18.

15. \$30 is __% of \$210.

16. 450 is __% of 675.

17. 24 is __% of 64.

18. __% of \$30 is \$25.

19. 231 is __% of 350.

20. 36 is __% of 3000.

21. __% of 500 is 373.

Finding Per Cents in Problems

1. Ellen earns \$28 per week. She saves \$5 of her earnings each week. What per cent of her earnings does she save?

Give your answer for Problem 1 to the nearest whole per cent.

Try to solve Problem 2 in your head. Think: \$$1\frac{1}{4}$ is what fraction of \$5? \$$1\frac{1}{4}$ is __% of \$5.

2. Ellen buys savings stamps with \$1.25 of her savings each week. What per cent of her savings does she use to buy savings stamps?

3. Mr. Burroughs had \$500 in a savings account. He made no withdrawals and no deposits for a year. At the end of the first six months his bankbook showed that the \$500 had earned \$3.75 interest during the half year. What annual rate of interest had been paid?

4. Last year Miss Mayer's total income was \$2700. She spent \$2250 of this amount and saved the rest. What per cent of her income did she spend last year?

5. What per cent of her income did Miss Mayer save last year?

One way to solve Problem 5 is to think of Miss Mayer's total income as 100%. What should you do next?

6. One month Bill Holden received \$225 commission on sales of \$5000. Find his rate of commission.

7. Mr. Hudson bought a farm that cost \$5600. Six months later he sold the farm for \$600 more than it had cost him. To the nearest tenth of a per cent, what per cent of profit did he make?

Larger Per Cents in Comparing Numbers

When Bob was 8 years old, his uncle deposited \$200 in a savings account for him. No deposits or withdrawals were made until Bob was 18 years old. Then the account amounted to \$244. This was what per cent of the amount deposited?

Should the answer be more than or less than 100%? You divide 244 by 200 because you are to find what per cent \$244 is of \$200.

Example A shows how to find what per cent 244 is of 200. Which number is the divisor?

Is the dividing done correctly? Notice that there are two decimal places in the answer for the work in division. $244 \div 200 = 1.22$.

A

\$244 is $\frac{244}{200}$ of \$200.

$$\begin{array}{r} 1.22 \\ 200\overline{)244.00} \\ \underline{200} \\ 44\,0 \\ \underline{40\,0} \\ 4\,00 \\ \underline{4\,00} \end{array}$$

$1.22 = 122\%$

When you change 1.22 to a per cent, the decimal point comes at the extreme right. Why is it unnecessary to write the point? What sign do you write?

$1.22 = 122\%$. \$244 is __% of \$200. Is 122% a reasonable answer to the question in the problem?

1. Is it correct to say that the total interest for the 10 years was 22% of the \$200? Why?

2. Do you think the interest was compounded on this account? Why?

3. Since $\frac{1}{10}$ of 22% is 2.2%, is it correct to say that the bank paid interest at the rate of 2.2% per year? Explain your answer.

4. The seventh grade in the Jones School bought \$12 worth of savings stamps one week and \$24 worth the next week. The second week's sales were what per cent of the first week's sales?

Why should the answer for Problem 4 be more than 100%? Should you use 24 or 12 as the divisor? Why?

How many decimal places are in the answer for the division in Example B? Think of the reason for writing the two zeros in the answer.

How do you change 2.00 to a per cent? 2.00 = __%.

The second week's sales were __% of the first week's sales. \$24 is __% of \$12.

B

\$24 is $\frac{24}{12}$ of \$12.

$$\begin{array}{r} 2.00 \\ 12\overline{)24.\mathbf{00}} \\ \underline{24} \end{array}$$

2.00 = 200%

Solve Problems 5, 6, and 7. Then compare your work with Self-Help Examples C, D, and E on page 229.

5. A new book costs \$1.85. A second-hand copy of the book costs \$.74. The price of the new book is what per cent of the price of the second-hand copy?

Should your answer for Problem 5 be more than or less than 100%? Your work may be easier if you change \$.74 and \$1.85 to cents before you divide. Why? Should you use 185 or 74 for the divisor? How many decimal places should you be sure to have in the answer when you divide? What should you do next?

6. Mr. Lee borrowed \$300 for a year. At the end of the year he paid back \$318 for principal and interest. He paid back what per cent of the amount he borrowed? What was the rate of interest?

C	D	E
\$1.85 is $\frac{185}{74}$ of \$.74.	\$318 is $\frac{318}{300}$ of \$300.	210 lb. is $\frac{210}{120}$ of 120 lb.
2.50 74)185.**00** 148 370 370	1.06 300)318.**00** 300 1800 1800	1.75 120)210.**00** 120 900 840 600 600
2.50 = 250%	1.06 = 106%	1.75 = 175%

7. In July Dan collected and sold 210 lb. of waste paper. In August he collected and sold only 120 lb. The amount he collected and sold in July was what per cent of the amount he collected and sold in August?

Perhaps you can do Problem 8 in your head. Try it.

8. Lorraine's weekly allowance was \$1. Then her allowance was raised to \$2.25. Her new allowance was what per cent of her old allowance?

9. Mr. Jones planted 24 bushels of potatoes last year and harvested 252 bushels. He harvested what per cent of the amount he had planted?

Why do you use 2.8 for the divisor in Example 10?

10. 14 is __% of 2.8.

11. 10 is __% of 8.

12. __% of 15 is 24.

13. \$10 is __% of \$1.

14. \$6 is __% of \$5.

15. __% of 75 is 225.

16. 36¢ is __% of 8¢.

17. __% of 13.2 is 1.32.

18. __% of \$3.60 is \$8.10.

19. __% of 800 is 1200.

Mixed-Number Per Cents Larger than 100%

Mr. Price has invested \$75 in a bond. If he keeps the bond for 8 years, it will then be worth \$92. To the nearest tenth of a per cent, it will then be worth what per cent of the amount Mr. Price invested in it?

Example A shows how to find the answer. How do you know that the answer should be more than 100%? Why should you divide 92 by 75?

Divide until you have three decimal places because you are asked to find the answer to the nearest tenth of a per cent.

A
\$92 is $\frac{92}{75}$ of \$75.
$\frac{92}{75} = 92 \div 75 = 1.226\frac{50}{75}$, or 1.227
$1.227 = 122.7\%$

Why do you round off $1.226\frac{50}{75}$ to 1.227?

How do you change 1.227 to a per cent?

Would 122% or 123% be the answer correct to the nearest whole per cent? How do you know?

1. Mr. Price's bond will be worth \$100 if he keeps it for 10 years. It then will be worth what per cent of the money invested in it?

Should the answer be more than or less than 100%?

Why is 75 used for the divisor? Divide 100 by 75, as in Example B.

Why do you divide to only two decimal places? How do you get $\frac{1}{3}$ in the answer?

$1.33\frac{1}{3} = \_\_\%$.

Which is better, to give the answer as $133\frac{1}{3}\%$ or as 133%? Why?

B
\$100 is $\frac{100}{75}$ of \$75.
$\frac{100}{75} = 100 \div 75 = 1.33\frac{1}{3}$
$1.33\frac{1}{3} = 133\frac{1}{3}\%$

C	D	E
\$20.50 is $\frac{20.50}{18.75}$ of \$18.75.	\$47.00 is $\frac{47.00}{37.50}$ of \$37.50.	\$49.00 is $\frac{49.00}{37.50}$ of \$37.50.
$\frac{20.50}{18.75} = 20.50 \div 18.75 =$ $1.093\frac{625}{1875}$, or 1.093	$\frac{47.00}{37.50} = 47.00 \div 37.50 =$ $1.253\frac{1250}{3750}$, or 1.253	$\frac{49.00}{37.50} = 49.00 \div 37.50 =$ $1.306\frac{2500}{3750}$, or 1.307
1.093 = 109.3 %	1.253 = 125.3 %	1.307 = 130.7 %

Now solve Problems 2, 3, and 4, giving each answer to the nearest tenth of a per cent. Compare your work with Self-Help Examples C, D, and E.

2. A bond costing \$18.75 is worth \$20.50 in 5 years. It is then worth what per cent of its cost?

Why should the answer for Problem 2 be more than 100%? Why do you divide to three decimal places?

3. A bond that costs \$37.50 is worth \$47.00 in $8\frac{1}{2}$ years. It is then worth what per cent of its cost?

The answer for Problem 3 should be __ than 100%.

4. A bond that costs \$37.50 is worth \$49.00 in $9\frac{1}{2}$ years. It is then worth what per cent of its cost?

5. To the nearest whole per cent, 120 is what per cent of 97?

6. To the nearest tenth of a per cent, 260 is what per cent of 48?

Give each answer below to the nearest whole per cent.

7. 67 is __% of 15.

8. \$59 is __% of \$8.

9. 248 is __% of 125.

10. __% of 30 is 95.

11. 120 is __% of 55.

12. __% of 180 is 210.

13. __% of 86 is 93.

14. __% of 21 is 70.

Finding Per Cent of Increase and Decrease

1. Read what Harry and Peter said in Picture 1 on the next page. Peter made a mistake in thinking. Do you know what it is?

2. Now read Picture 2. Peter made another mistake in this picture. Can you find it?

3. In Picture 3 how was Peter able to figure in his head quickly that $25 is 20% of $125?

4. Read Picture 4. Had Peter been right or wrong in Picture 1? Why?

5. In Pictures 1 to 4 Harry and Peter found the per cents by which the two investments had increased. The boys found the *per cent of increase.* Why can you say that in Pictures 5 and 6 they found the *per cent of decrease?*

When you find the per cent of increase or decrease, be sure to divide by the number that has been increased or decreased.

6. Mr. Wilson's salary was increased from $240 per month to $252 per month. What was the per cent of increase?

7. On Oct. 31 Edna's savings-account balance was $4.80. On Nov. 30 it was $3.60. By what per cent had her balance decreased?

Find the per cent of increase or decrease for:

8. A change in salary from $40 to $42.

9. A change in salary from $120 to $132.

10. A change in rent from $60 to $54.60.

11. A change in taxes from $115 to $121.90.


MY FATHER JUST SOLD TWO INVESTMENTS THAT HE BOUGHT TEN YEARS AGO. ONE OF THEM COST $125, AND HE SOLD IT FOR $150. THE OTHER ONE COST $240, AND HE SOLD IT FOR $280.
THEN HE MADE A PROFIT OF $40 ON THE SECOND INVESTMENT AND ONLY $25 ON THE FIRST ONE. THE SECOND INVESTMENT WAS MUCH BETTER, WASN'T IT, HARRY?
YOU'RE FORGETTING, PETER, THAT HE HAD MORE MONEY IN THE SECOND INVESTMENT. WE CAN'T TELL WHICH WAS THE BETTER INVESTMENT UNTIL WE FIND WHAT PER CENT OF PROFIT HE MADE ON EACH.
THAT SHOULDN'T BE HARD TO DO. HE MADE A PROFIT OF $25 ON THE FIRST INVESTMENT, AND THAT'S ONE SIXTH OF $150.
WAIT A MINUTE! YOU CAN'T FIGURE THE PER CENT THAT WAY. HE MADE THE PROFIT OF $25 ON $125, NOT ON $150.
YOU'RE RIGHT, HARRY. HIS $25 PROFIT ON THE FIRST INVESTMENT IS ONE FIFTH OF $125. SO HE HAS MADE A PROFIT OF 20%.
ON THE SECOND INVESTMENT HE MADE $40. NOW WE'LL HAVE TO FIND WHAT PER CENT $40 IS OF $240. IS THAT RIGHT, PETER?
YES, THAT'S RIGHT. $40 IS ONE SIXTH, OR 16⅔%, OF $240. SINCE YOUR FATHER MADE 20% ON THE FIRST INVESTMENT AND ONLY 16⅔% ON THE OTHER INVESTMENT, THE FIRST INVESTMENT WAS THE BETTER ONE.
SUPPOSE MY FATHER SOLD FOR $125 AN INVESTMENT THAT COST $150. HIS LOSS WOULD BE $25, OF COURSE. BUT TO FIND HIS RATE OF LOSS, SHOULD I FIND WHAT PER CENT $25 IS OF $125 OR OF $150?
YOU FIND WHAT PER CENT $25 IS OF $150 BECAUSE YOU MUST FIND WHAT PER CENT $25 IS OF THE MONEY HE INVESTED, NOT OF THE MONEY HE RECEIVED WHEN HE SOLD THE INVESTMENT.
THAT'S REASONABLE, PETER. $25 IS ONE SIXTH, OR 16⅔% OF $150; SO MY FATHER WOULD LOSE 16⅔%. THAT WOULD BE A BIG LOSS. I'M GLAD IT DIDN'T REALLY HAPPEN.

Problems for Good Thinkers

1. Mr. Smith lent Mr. Davis $150 at 6% interest. At the end of 1 year Mr. Davis paid Mr. Smith 106% of the amount he had borrowed. Did he pay the correct amount? How do you know?

2. If Mr. Davis had waited for 2 years to pay back the money, what per cent of the amount borrowed would he have had to pay?

3. Mary Harvey has saved $120. Her younger sister Nancy has saved $80. Mary's savings are __% of Nancy's. Nancy's savings are __% of Mary's.

4. If each girl should increase her savings by 25%, Nancy's savings would then be __% of Mary's.

5. Mary's savings would then be __% of Nancy's.

6. John's savings are 150% of Sam's savings, and Ralph's savings are $33\frac{1}{3}$% of John's. Which boy has the largest savings? How do you know?

7. Sam's savings amount to $24. Find the savings of each of the other two boys.

8. Susan's savings are 75% of Ann's, and Betty's savings are $133\frac{1}{3}$% of Susan's. Which girl has the smallest savings? How do you know?

9. Ann's savings amount to $24. Find the savings of each of the other two girls.

10. Henry's savings are 150% of Joe's, and Tom's savings are 50% of Joe's. Tom's savings are __% of Henry's. Joe's savings are __% of Tom's.

11. 50% of Dick's money equals 150% of Bill's money. Does Dick have more money or less money than Bill? How do you know?

Without Pencil

	A	B	C	D	E	F
1.	\$82.30 3.50 7.60	$2\frac{1}{2}\%$ = what decimal ?	13.5 22.0 14.5	$\frac{1}{4}+\frac{3}{4}+\frac{2}{3}$	$33\frac{1}{3}\%$ of \$3000 = \$_____	$.9\overline{)1458}$
2.	.0075 = ____ %	$\frac{2}{3} \times \frac{7}{16}$	Multiply: 3.08 .02	24 is $\frac{?}{6}$ of 144.	$3\frac{1}{5} - \frac{4}{5}$	$\frac{5}{6}$ = ___%
3.	$99\overline{)297}$	.005 is ___ of .01.	Subtract: 7 yr. 3 mo. 4 yr. 5 mo.	Fraction equivalent for $62\frac{1}{2}\%$ is _____.	$\frac{3}{25}$ = what decimal ?	$\frac{320}{100}$ in simplest form is ______.
4.	Add: $7\frac{3}{8}$ $4\frac{13}{16}$	Subtract: \$70.60 9.75	Multiply: 36 $1\frac{1}{2}$	3 × 4 × 5	$\frac{9}{10} \div \frac{3}{5}$	300% of 25 = ____

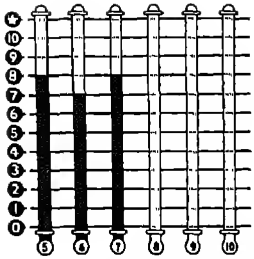
Think before You Answer

1. When you are to find what per cent one number is of another to the nearest whole per cent, what is the smallest number of decimal places that you should be sure to have when you divide? Why?

2. When you are to find an answer to the nearest tenth of a per cent, how many decimal places should you be sure to have when you divide? Why?

3. To find what per cent Number A is of Number B, do you divide Number A by Number B or do you divide Number B by Number A? Why?

4. Is it possible for a man to spend 150% of the money that he has? Explain your answer.



Self-Testing Drill 8

You will have exactly *20 minutes* for this drill. If you finish before the time is up, try "A Side-Trip in Mathematics" on the next page.

Examples 10 and 12 are wrong unless you have all three parts correct.

1. Subtract:
$$\begin{array}{r} 1302486 \\ \underline{900689} \end{array}$$

2. Subtract:
$$\begin{array}{r} 107.49795 \\ \underline{72.87980} \end{array}$$

3. Multiply:
$$\begin{array}{r} .103 \\ \underline{.708} \end{array}$$

4. $4\frac{1}{6} \div \frac{5}{6} =$

5. Find a 2% discount on $1799.

6.
$$\begin{array}{r} .476 \\ 3.789 \\ .607 \\ 7.969 \\ 8.855 \\ \underline{4.549} \end{array}$$

7. Find the average:
$$\begin{array}{r} 7900 \\ 59632 \\ 3867 \\ 83109 \\ \underline{76677} \end{array}$$

8. What must be added to $14\frac{2}{3}$ to make $28\frac{1}{2}$?

9. Find 82% of $77.50.

10. (*a*) 1 bu. 2 pk. = __ pk.
(*b*) 1 pk. 2 qt. = __ qt.
(*c*) 1 qt. 1 pt. = __ pt.

11.
$$\begin{array}{r} \text{2 pk. 7 qt.} \\ \text{3 pk. 2 qt.} \\ \underline{\text{1 pk. 4 qt.}} \end{array}$$

12. Write on your paper the number that belongs where each question mark is below.

	FRACTION	DECIMAL	PER CENT
a	?	.4	40 %
b	$\frac{3}{2}$, or $1\frac{1}{2}$	1.5	?
c	$\frac{3}{8}$	?	$37\frac{1}{2}$ %

13. 260 is __% of 208.

14. 168 is __% of 84.

15. Divide 6 bu. 2 pk. by 3.

16. 9×1 bu. $2\frac{1}{4}$ pk.

17. $857\overline{)50546}$

18. Multiply:

$$\begin{array}{r} 865 \\ \underline{457} \end{array}$$

19. Multiply 8075 by 6890.

20. Find the interest on $850 for 2 yr. 3 mo. at $6\frac{1}{2}\%$.

Standards for Self-Testing Drill 8

Number Correct	0	1–3	4	5	6–7	8	9	10	11–12	13–14	15–19	20
Rating	0	1	2	3	4	5	6	7	8	9	10	★

A Side-Trip in Mathematics

You can often save yourself work by changing large fractions to simplest form. For example, when you find what per cent 70 is of 1750, you can use the fraction $\frac{1}{25}$ instead of the fraction $\frac{70}{1750}$. Why can you do this? How do you get $\frac{1}{25}$?

1. If you had to find what per cent 165 is of 231, why could you use the fraction $\frac{5}{7}$? To change $\frac{165}{231}$ to $\frac{5}{7}$, you may first divide 165 and 231 by 3. Why? Does $\frac{165}{231}$ equal $\frac{55}{77}$? What do you do next?

2. What is the simplest fraction you can use to find what per cent 336 is of 384?

3. How can you tell by looking at two numbers whether or not you can divide both of them exactly by 2? By 5?

4. Can you divide exactly by 3 some numbers that end in 4? That end in 5?

5. Write each fraction below as a per cent. First change each fraction to the simplest form that you can.

$\frac{78}{104}$ $\frac{99}{297}$ $\frac{55}{121}$ $\frac{2000}{3125}$ $\frac{165}{450}$ $\frac{360}{600}$ $\frac{198}{270}$

Learning through Practice

Add:

1.	$1\frac{1}{8}$	$12\frac{1}{3}$	$27\frac{1}{10}$	$108\frac{1}{5}$	$370\frac{1}{16}$	$358\frac{1}{10}$
	$2\frac{3}{8}$	$83\frac{1}{2}$	$64\frac{3}{4}$	923	$601\frac{5}{16}$	691
	$9\frac{5}{8}$	$79\frac{1}{3}$	$18\frac{1}{4}$	$452\frac{1}{5}$	$569\frac{3}{16}$	742
	$8\frac{7}{8}$	$30\frac{2}{3}$	$22\frac{9}{10}$	$687\frac{1}{2}$	274	$877\frac{1}{10}$

Subtract:

2.	931	93542	67372	1.145	$9563\frac{3}{5}$	\$76.20
	275	79864	$49529\frac{1}{4}$	.577	4986	8.64
3.	847	$91623\frac{11}{12}$	825185	3482	\$543.10	8166
	378	$83969\frac{5}{12}$	125497	1606	63.71	4879

Multiply:

4.	819	608	5497	.125	31.25	7.68
	17	184	79	16	4.8	.364
5.	748	49.3	31.25	72	639	.0369
	369	1.28	.48	8.5	62	1.07

6. $4\frac{5}{6}\times2\frac{1}{4}$ $\quad$ $25\times876\frac{1}{5}$ $\quad$ $\frac{5}{6}\times2\frac{3}{5}$ $\quad$ $3\frac{1}{3}\times5\frac{1}{16}$

7. $4\frac{1}{4}\times2\frac{2}{5}$ $\quad$ $28\frac{2}{3}\times3018$ $\quad$ $1\frac{7}{8}\times1\frac{1}{3}$ $\quad$ $8\frac{1}{3}\times6\frac{3}{5}$

Divide:

8. $8.5\overline{)68}$ $\quad$ $1.6\overline{)1}$ $\quad$ $9\overline{)164.7}$ $\quad$ $.43\overline{).4}$

9. $18\overline{)8434}$ $\quad$ $8.7\overline{)30.36}$ $\quad$ $94\overline{)94376}$ $\quad$ $11.25\overline{).3}$

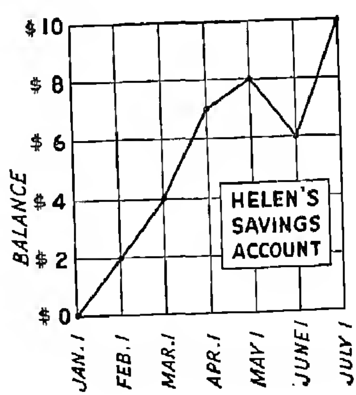
10. $46\overline{)1334}$ $\quad$ $60\overline{)40.86}$ $\quad$ $4.56\overline{).1824}$ $\quad$ $2.69\overline{).7}$

11. $\frac{2}{5}\div\frac{1}{2}$ $\quad$ $2\frac{1}{6}\div4\frac{1}{5}$ $\quad$ $4\frac{7}{8}\div2\frac{1}{16}$ $\quad$ $4\frac{13}{16}\div3$

Checking Up

If you can do the work on this page and the next page, you are ready for Chapter 5.

1. Write *300 million 670 thousand 4* in figures.
2. Write *85 millionths* in figures as a decimal.
3. Find a commission of 5% on a sale of \$98.
4. Write the formula for finding interest.
5. Find the interest on \$640 at 5% for 9 months.
6. The principal of a note is \$250. The interest rate is $4\frac{1}{2}\%$. Find the interest for 21 months.
7. At 5%, the interest on a note will equal the principal in __ yr.
8. Write as per cents: .01, .015, .263, 1.47, 2.3.
9. What is the common fraction equivalent for $83\frac{1}{3}\%$?
10. Compare 14 with 70 by finding a per cent.
11. 9 grams is __ % of 6 grams.
12. Use the graph below to find the balance in Helen's savings account on April 1.
13. How do you know that Helen withdrew money? Can you be sure that Helen did not withdraw any money in April? Why?
14. \$98 is .35 of \$__.
15. __% of 380 is 133.
16. $\frac{3}{4}\%$ of \$654 is \$__.
17. 136% of 344 is __.
18. \$2.80 is $\frac{4}{5}$ of \$__.
19. $6\frac{1}{4}\%$ of \$1224.40 is \$__.
20. 1.8% of 240 is __.
21. 9 sq. mi. = __ A.



22. Find the areas of the rectangles whose dimensions are given below.

8 ft. x 3 ft. 5 ft. x $3\frac{1}{4}$ ft. 3 in. x 1.5 ft.

23. Write as decimals: 27.1%, 4%, $116\frac{2}{3}$%, $11\frac{1}{2}$%, 51%.

24. Find the rate of interest if $800 earns $28 in one year.

25. 300% of a number is __ times the number.

26. 150% of a number is __ times the number.

27. Write each fraction below as a decimal correct to the nearest thousandth.

$\frac{1}{27}$ $\frac{17}{32}$ $\frac{119}{120}$ $\frac{47}{313}$ $\frac{115}{217}$ $\frac{8}{53}$

28. Which is less, .3142 meter or .2142 meter?

29. Which is more, .999 liter or .9989 liter?

30. What coin is equal to 1% of a dollar? To 25% of a dollar?

31. Write the per cent that is equivalent to each fraction below.

$\frac{3}{4}$ $\frac{5}{6}$ $\frac{1}{3}$ $\frac{9}{10}$ $\frac{3}{8}$ $\frac{1}{5}$ $\frac{2}{3}$ $\frac{7}{8}$ $\frac{1}{6}$

32. Write the decimal equal to each per cent below.

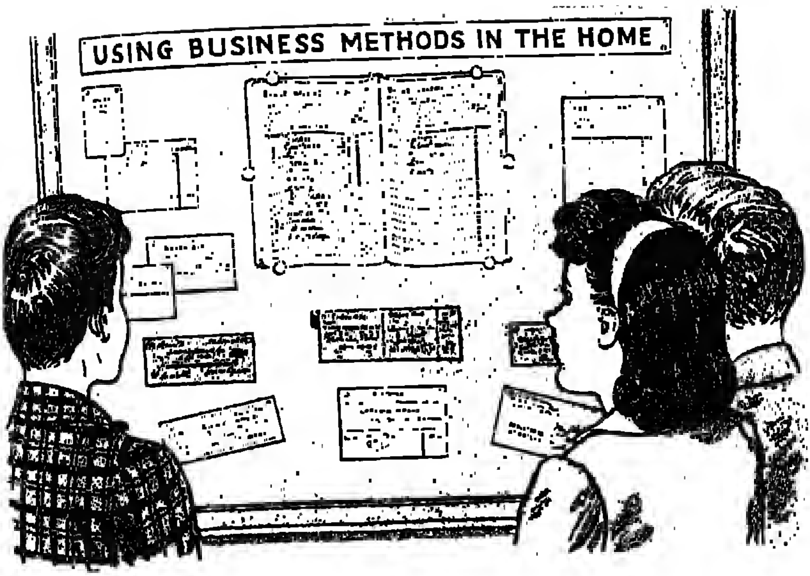
$\frac{3}{4}$% $\frac{3}{8}$% $\frac{1}{2}$% $\frac{2}{5}$% $\frac{1}{3}$% $\frac{5}{8}$% $\frac{4}{5}$%

33. When you multiply by $.00\frac{1}{2}$, should you point off two or three decimal places?

34. How many decimal places should you point off when you multiply by .005?

35. Does $.00\frac{1}{2}$ mean the same as .005?

36. Would you save more by a discount of $\frac{3}{4}$% or by a discount of 1¢ on each dollar?



CHAPTER 5

Using Business Methods in the Home

The Home Is Really a Business

When the boys and girls in Miss Wilson's class studied business methods in the home, they made the bulletin-board display shown above. They put on the bulletin board all the things they could think of that show how running a home is like running a business.

They decided that every home manager should have a budget, which is the basis of good money management. You have already studied budgets, and you know how they are made and used.

The class put a savings bankbook on the bulletin board because the boys and girls felt that it is difficult to manage a home in a businesslike way unless money is saved for emergencies, education, and old age.

The boys and girls realized that a good home manager needs to know how her money has been spent; so she must keep accounts. The home manager's accounts will show how well her budget is working and how it can be improved.

The class also decided that a home manager should know how to handle certain business forms. When she pays bills, for example, she may pay some by check, others in cash, and still others by money order. She must know when it is necessary to ask for a special receipt showing that money has been paid out and when she can safely do without a receipt. She cannot know this unless she understands canceled checks, stubs for money orders, and receipted bills.

No one can keep budgets and accounts, write checks, and keep track of bills and receipts efficiently without a good knowledge of mathematics. Every home manager uses mathematics over and over again. In this chapter you are going to learn something about the kind of mathematics that is needed when a home is managed in a businesslike way.

1. When following a budget, why is it necessary to keep a record of money received and money spent?

2. Why might it be necessary to spend in one month more than that month's share of the food budget?

3. If more than the amount allowed for food is spent in one month, what should be done during the following months? Why?

4. Should money that you intend to use in a few weeks be put in your savings account? Why?

5. What are gas and electric meters for?

6. Should a good home manager know how to read gas and electric meters? Why do you think so?

7. Is it sometimes wise to buy certain goods at discount sales even though you might spend more than your budget allows for that month? Why?

8. In what way might you be helped by keeping a record of the money that you receive and spend?

9. If you owe money to someone who lives a great distance away, how can you send him the money?

10. Is it wise to send money in an ordinary letter? Why?

11. Can coins and paper money ever be sent safely through the mail? If so, how?

12. Why do stores send out bills to customers?

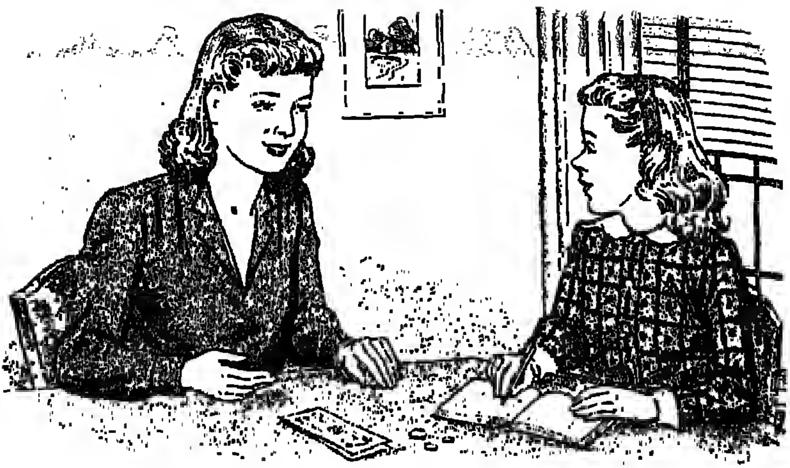
13. Do all customers of stores receive bills? Explain your answer.

14. Sometimes when a person wants to cash a check or a money order, he is asked to *identify* himself. This means he must prove that he is the person named on the check or money order. How could you identify yourself?

15. When you have paid a bill with cash, how can you prove later that the bill has been paid?

16. Why is it important to keep some bills for a reasonable period of time after they have been paid?

17. If you bought a \$15 money order at the post office, you would have to pay a small fee. Why is this fee charged? Why are people willing to pay this fee instead of mailing cash?



Cash Accounts

When Mrs. Lyle gave Jean a cash-account book, she said that if Jean kept careful accounts it would help her manage her money efficiently. Jean's account for January is shown on the next page. When she began her account on Jan. 1, she had $5.60 in cash. So she wrote $5.60 under *receipts* as *cash on hand.* Receipts means *money received.* Think of the $5.60 as received on Jan. 1 from Jean's December account.

1. On what dates did Jean receive money? How do you know which items are receipts?

2. Money paid out should be written in the column labeled *expenditures.* On what dates did Jean pay out money?

3. On Jan. 31, Jean counted her cash on hand. She had a half dollar, 2 quarters, 2 dimes, 2 nickels, and 3 pennies. How much cash did she have on hand?

4. Where did Jean write the amount of money she had left at the end of the month?

5. If Jean has kept her account correctly and lost no money during the month, the totals of the receipts' column and of the expenditures' column will be equal. How do you know that Jean's account is correct?

6. If the total of the receipts' column is exactly equal to the total of the expenditures' column, the account *balances*. Did Jean's January account balance?

7. Why is it wrong to say that Jean *spent* \$9.25 in January? Was her *income* more than or less than \$9.25 in January? Explain your answer.

8. What amount should Jean write as cash on hand for Feb. 1?

9. The total amount of money that Jean has is her cash on hand plus the balance in her savings account. Did she have more or less money on Feb. 1 than on Jan. 1? How much more or less did she have?

10. If Jean had lost 10¢ during the month, should she have written 10¢ in the receipts' column or in the expenditures' column? Why?

1948		ITEMS	RECEIPTS		EXPENDITURES	
Jan.	1	Cash on hand	5	60		
	1	Month's allowance	2	50		
	3	Drawing materials				92
	6	Movie				25
	8	Wheeling Kent baby		40		
	15	Given to Community Chest			1	00
	20	Caring for Kent baby		75		
	20	Movie				25
	24	Betty's birthday gift				50
	27	Deposited in savings account			5	00
	31	Cash on hand			1	33
		TOTALS	9	25	9	25

Jean's Accounts

Jean's February and March accounts are on page 247. Some of her figures have been left out for you to find.

1. How did she know that she should write $1.33 as the cash on hand for Feb. 1? See page 245.

2. Find the total of the February receipts' column.

3. Jean had the following cash on Feb. 28: 3 quarters, 2 dimes, 2 nickels, and 8 pennies. What should be written opposite *cash on hand* for Feb. 28?

4. This cash on hand should be written in the _ column. What is the total of this column?

5. Does Jean's account for February balance?

6. How much was her real income for February?

7. How much did she really spend during February?

8. What was her cash on hand March 1?

9. What is the total of the March receipts' column?

10. Jean had $.73 cash on hand March 31. Had she lost any money during the month? How do you know?

11. Use a ruler and pencil to make an account page for Jean's April account. Here are the new facts you need: Apr. 1, allowance, $2.50; Apr. 7, movie, 25¢; Apr. 10, bought book for $1.25; Apr. 14, received 75¢ for helping Mrs. Jones; Apr. 21, bought hair bow for 23¢; Apr. 28, received 90¢ for taking care of the Kent baby; Apr. 30, deposited $3.00 in savings account; Apr. 30, cash on hand, $.15.

12. If Jean withdrew $2.00 from her savings account, why should she enter $2.00 as a receipt on her cash account?

1948		ITEMS	RECEIPTS		EXPENDITURES	
	1	Cash on hand	1	33		
	1	Month's allowance	2	50		
	3	Share of skating party				20
	5	Present from Uncle Jim	1	50		
	5	2 pr. stockings			1	00
	12	Valentines				55
	24	Helping Mrs. Kent		40		
	24	Movie				25
	26	Birthday present for Father				60
	28	Deposited in savings account			2	00
	28	Cash on hand				
		TOTALS				

1948		ITEMS	RECEIPTS		EXPENDITURES	
	1	Cash on hand				
	1	Month's allowance	2	50		
	3	Concert				50
	5	Club dues.				25
	10	Helping Grandmother		90		
	17	Caring for Kent baby		50		
	20	Repairing skates				80
	24	Movie				25
	26	Caring for Kent baby		50		
	30	Doing extra dishes for Mother		50		
	31	Deposited in savings account			3	50
	31	Cash on hand				
		TOTALS				

The Wilson Family's Accounts

The Wilsons estimated that their family income for 1948 would be $2400. Their budget is shown below.

1. Copy the budget and fill in the missing amounts.

2. There is a separate page in the Wilson account book for each budget heading. Page 249 shows the budget page for ___ for the month of ___.

3. The amount brought forward from the preceding month was $___. At the end of March the Wilsons had $2.68 left over from their food allowance.

4. On the next line Mrs. Wilson wrote the amount of the food allowance for April. What is this amount? Why could the Wilsons spend $52.68 for food in April?

5. Look at the date column. On how many days did the Wilsons buy food?

6. At how many stores did they buy food?

7. How much did they spend for food on April 2?

	WAGE DEDUCTIONS	SAVINGS	FOOD	SHELTER	CLOTHING	LIFE INSURANCE	OPERATING COSTS	HEALTH	ADVANCEMENT
PER CENT →	10	10	25	21	14	2	7	5	6
YEARLY AMOUNT									
MONTHLY AMOUNT									

BUDGET HEADING *Food* MONTH *April* YEAR *1948*

BROUGHT FORWARD FROM PRECEDING MONTH				2	68
BUDGET ALLOWANCE FOR MONTH				50	00
AMOUNT AVAILABLE FOR MONTH				52	68
DATE	*EXPENDITURES*				
2	Groceries at Martin's	2	79	2	79
3	Groceries at Martin's	1	93	4	72
5	Meat at Turner's	1	53	6	25
6	Bread and rolls at Beatly's		55	6	80
6	Fish at Turner's	1	26	8	06
7	Meat at Turner's	2	84	10	90
7	Groceries at Martin's	3	26	14	16
10	Cake at Beatly's		85	15	01
13	Groceries at Martin's	3	59	18	60
14	Bread and rolls at Beatly's		62	19	22
14	Meat at Turner's	1	37	20	59
20	Groceries at Martin's	1	43	22	02
21	Bread and rolls at Beatly's		59	22	61
21	Chicken at Turner's	1	90	24	51
26	Groceries at Martin's	2	10	26	61
27	Brown's delicatessen	1	14	27	75
28	Bread and rolls at Beatly's		65	28	40
28	Groceries at Martin's	4	75	33	15
28	Meat at Turner's	2	28	35	43
30	Paid Anderson's Dairy bill	13	70	49	13
	TOTAL EXPENDITURES	49	13	49	13
	BALANCE CARRIED FORWARD FOR NEXT MONTH			3	55

8. On Apr. 3 Mrs. Wilson bought $1.93 worth of groceries. She wrote $4.72 in the last column to show that so far in April $4.72 of the food budget had been spent. How did she get the $4.72?

9. How was the $6.25 found for Apr. 5?

10. $15.01 of the food budget had been spent by __.

11. How much had been spent by Apr. 21?

12. Why were the amounts in the last column useful to Mr. and Mrs. Wilson?

13. At the end of April did Mrs. Wilson write the correct sum on the total expenditures line?

14. She wrote this sum again in the last column and subtracted it from the amount available for the month to find how much money was left over. The amount left over is the balance carried forward for next month. Where should it be put on the page for May?

15. The record shown on page 251 is a part of the page for operating costs for what month? Mr. Wilson wrote the amount brought forward with a ring around it and with a minus sign. He did this to show that in March the family had spent $.75 more than the budget allowance for operating costs that month.

16. Why did he write $14 for the April allowance?

17. Why was only $13.25 available for April?

18. There were no operating expenses after Apr. 23. What were the total expenditures for operating costs?

19. Find the amount that Mr. Wilson should have written in the last column for each day. What balance should he have carried forward?

Problem 20 below gives all the facts from the Wilsons' page for clothing for April. With a ruler and pencil make a record page like the one on page 249. Then fill out the page just as you think the Wilsons might have done. Do the same thing for Problem 22.

20. Brought forward from March for clothing, \$2.50. Expenditures for the month: Apr. 3, dress for Mary, \$8; Apr. 9, shoes for John, \$4.50; Apr. 17, hat for Mrs. Wilson, \$5.25; Apr. 21, shoes for Mr. Wilson, \$6; Apr. 26, cloth and thread, \$3.44.

21. What is the balance carried forward to May?

22. By the end of March the Wilsons had spent \$5 more for shelter than their budget allowed. Their expenses for shelter in April were: \$15.12 for taxes on Apr. 2; \$22.18 for payment on mortgage on Apr. 10; and \$5.45 for repairs to roof on Apr. 24.

23. How much was spent in April for shelter?

24. Had the Wilsons "caught up" with their budget for shelter by the end of April?

BUDGET HEADING *Operating Costs* **MONTH** *April* **YEAR** *1948*

BROUGHT FORWARD FROM PRECEDING MONTH					-75
BUDGET ALLOWANCE FOR MONTH				14	00
AMOUNT AVAILABLE FOR MONTH				13	25
DATE	EXPENDITURES				
5	Water bill	2	35		
10	Repairs, hot water heater	3	10		
16	Telephone	1	75		
21	Gas, March 15 to April 15	2	85		
23	Electricity, March 15 to April 15	2	55		

Registered Mail

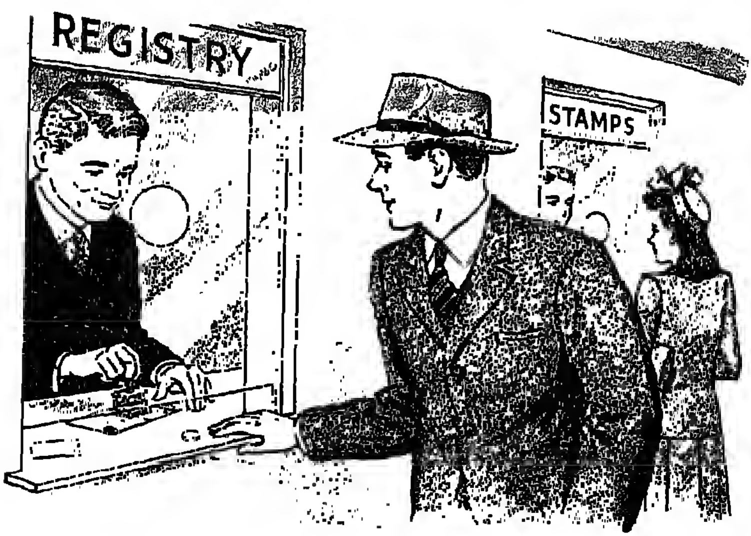
When Mr. Gregg sent his son Jim $10 in cash, he sent it by *registered mail* to be sure that it would reach Jim safely. The envelope of the letter in which the money was sent is shown on page 253.

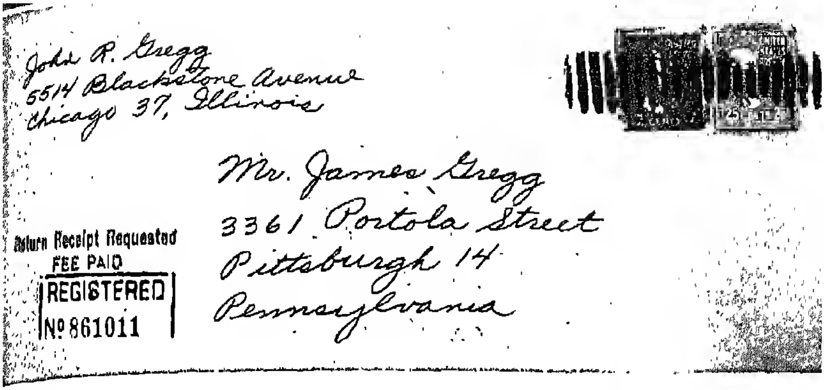
1. The postal clerk in Chicago stamped a *registry number* on the envelope. What is this number? Every postal clerk and mailman who handled the letter kept a record of it, using the registry number. Why?

2. Mr. Gregg paid 4¢ extra to have the mailman get a receipt from Jim. How does the envelope show that Mr. Gregg wanted a receipt?

3. When Jim received the letter, he signed a card which the postal service then returned to Mr. Gregg. How did this card act as a receipt?

4. The letter cost Mr. Gregg 3¢ postage, 25¢ registry fee, and 4¢ for the return receipt. He put a 7¢ and a 25¢ stamp on the letter. Was this correct?





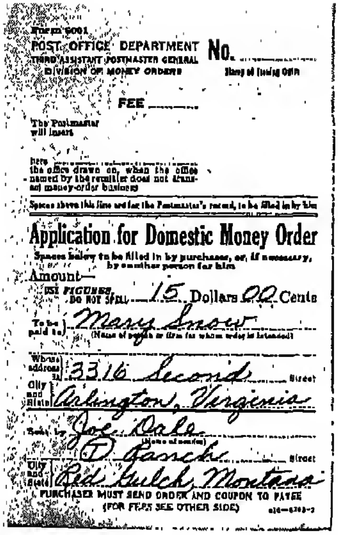
5. Money and small valuable articles are often sent by registered mail. If such mail is lost, the government will pay the sender the amount he set as the value. If Mr. Gregg's letter had been lost, the government would have paid him $__.

The table below shows registry fees for 1946. Use the table to find the cost of registering and mailing each article listed below. Include postage at 3¢ per ounce and 4¢ for a return receipt.

6. $100; 2 oz.
7. $200; 1 oz.
8. $201; 1 oz.
9. $25; 4 oz.
10. $25.50; 4 oz.
11. $1000; 3 oz.
12. $31; 4 oz.
13. $5.39; 5 oz.
14. $1; 1 oz.

15. What will it cost to register and mail a 3-oz. letter valued at $275? No return receipt is wanted.

Value of Article	Fee	Value of Article	Fee
Up to $5.00	$ .20	$400.01 to $500.00	$ .95
$5.01 to $50.00	.25	$500.01 to $600.00	1.05
$50.01 to $75.00	.35	$600.01 to $700.00	1.15
$75.01 to $100.00	.40	$700.01 to $800.00	1.20
$100.01 to $200.00	.55	$800.01 to $900.00	1.25
$200.01 to $300.00	.65	$900.01 to $1000.00	1.35
$300.01 to $400.00	.80		


Form 6001
POST OFFICE DEPARTMENT No. ____
THIRD ASSISTANT POSTMASTER GENERAL
DIVISION OF MONEY ORDERS
FEE ____
The Postmaster will insert here the office drawn on, when the office named by the remitter does not transact money-order business
Application for Domestic Money Order
Amount—
USE FIGURES DO NOT SPELL 15 Dollars 00 Cents
To be paid to Mary Snow
Whose address 3316 Second Street
City and State Arlington, Virginia
Sent by Joe Dale
D Ranch Street
City and State Red Gulch, Montana
PURCHASER MUST SEND ORDER AND COUPON TO PAYEE
(FOR FEES SEE OTHER SIDE)

Postal Money Orders

Mr. Dale, who lives in Montana, planned to send his niece Mary Snow in Virginia \$15 for her birthday.

He decided to send her a money order for the amount.

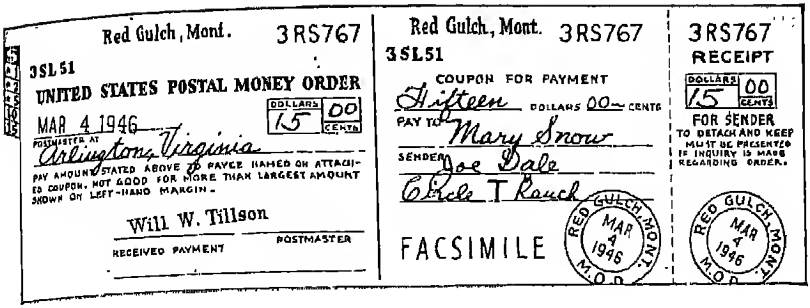
When he went to the post office to buy the money order, he first filled out the *application* shown at the left. The clerk then wrote out the money order shown on page 255. He charged Mr. Dale a 22¢ fee for the money order. Mr. Dale gave him \$15.22.

1. Why did Mr. Dale have to give the clerk \$15.22 instead of only 22¢?

The fees for postal money orders in 1946 are given below. Notice that the highest amount given is \$100. Whenever more than \$100 is to be sent, two or more money orders, totaling the amount, must be bought.

2. At the right end of the money order is a receipt, which Mr. Dale tore off and kept. He put the remaining part in the letter he sent to Mary. If the letter should be lost, the government would give him another money order. When would it have been safe for Mr. Dale to throw away this receipt?

Amount of Order	Fee	Amount of Order	Fee
\$ 0.01 to \$ 2.50	\$ .10	\$20.01 to \$ 40.00	\$ .25
\$ 2.51 to \$ 5.00	.14	\$40.01 to \$ 60.00	.30
\$ 5.01 to \$10.00	.19	\$60.01 to \$ 80.00	.34
\$10.01 to \$20.00	.22	\$80.01 to \$100.00	.37


Red Gulch, Mont. 3RS767
3SL51
UNITED STATES POSTAL MONEY ORDER
MAR 4 1946
DOLLARS 15 CENTS 00
POSTMASTER AT Arlington, Virginia
PAY AMOUNT STATED ABOVE TO PAYEE NAMED ON ATTACHED COUPON. NOT GOOD FOR MORE THAN LARGEST AMOUNT SHOWN ON LEFT-HAND MARGIN.
Will W. Tillson
POSTMASTER
RECEIVED PAYMENT

Red Gulch, Mont. 3RS767
3SL51
COUPON FOR PAYMENT
Fifteen DOLLARS 00 CENTS
PAY TO Mary Snow
SENDER Joe Dale
Clyde T Rauch
FACSIMILE
RED GULCH, MONT. MAR 4 1946 M.O.D.

3RS767
RECEIPT
DOLLARS 15 CENTS 00
FOR SENDER
TO DETACH AND KEEP
MUST BE PRESENTED IF INQUIRY IS MADE REGARDING ORDER.
RED GULCH, MONT. MAR 4 1946 M.O.D.

3. When Mr. Dale made out the application, what address did he give? What is Mary Snow's address?

4. As soon as Mary received the letter, she took the money order to the post office to get it *cashed*, that is, to get her money. The postal clerk knew Mary; so he told her to write her name on the line below the words *received payment*. He then gave her $15. Why did he not give her $15.22?

5. If the clerk had not known Mary, she would have had to *identify* herself, that is, prove she was really Mary Snow and not some other person. How might Mary have identified herself?

6. Look at the table on page 253 to find what the registry fee would have been if Mr. Dale had sent the $15 in cash by registered mail. If he had sent it by registered mail without a return receipt, it would have cost how much more than the way he sent it?

7. Find the amount of the fee for each money order below. How much should the postal clerk collect for each one?

Row A	$25.00	$18.50	$100	$5.50	$52.50	$1
Row B	$37.50	$2.51	$3.05	$250	$73.75	$.51
Row C	$87.50	$39.95	$1.76	$9.25	$80.00	$.78

Sending Money by Checks

Mr. Wiley owed Tom Logan $2.50 for taking care of the Wileys' lawn. He knew that he would not see Tom for several days; so he mailed Tom the check shown on the next page.

Since Mr. Wiley had a checking account at his bank, a check was a safe and convenient way for him to send money by mail. Any person who has a checking account in a bank may write checks on that bank for as much money as he has in his checking account.

You may think of your check as a letter telling the bank to pay someone a certain amount of your money.

1. Read all the information on the check on page 257.

2. What is the name of Mr. Wiley's bank? In what city and state is this bank?

3. Banks will not cash a check before the time shown by the date on it. Tom could not have cashed the check before what date?

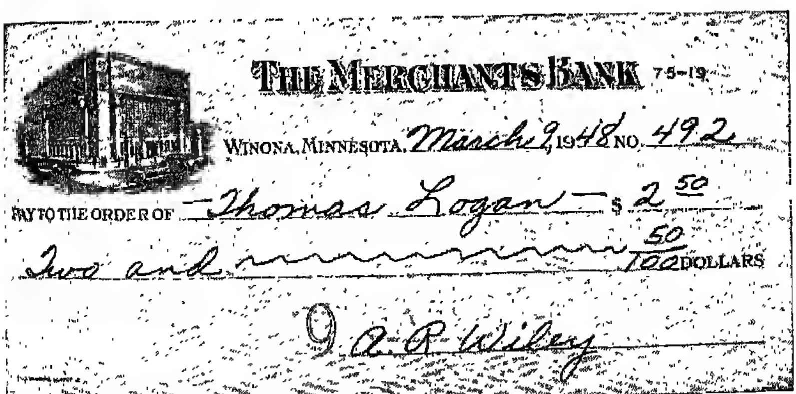
4. The words *pay to the order of* mean that the bank is to pay the amount of the check to the person whose name is written in the space after these words. How do you know that this check belongs to Tom Logan? How is his name written on the check?

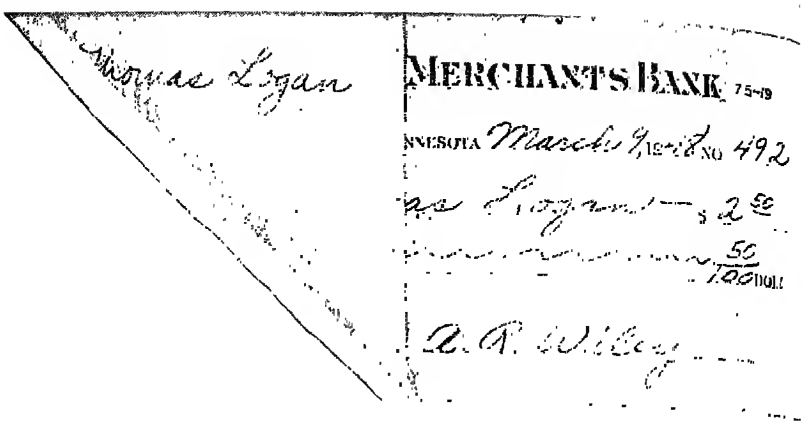
5. The amount of the check is written in two places on the check. Is the same amount written in both places? Is it written the same way both times? The bank may refuse to cash a check if the two amounts on it do not agree. Why?

6. How did Mr. Wiley sign his name? The bank knew that Mr. Wiley wrote this check, because he signed his name the way he always signs it on checks.

7. If Mr. Wiley had erased anything or marked over anything on the check, the bank might have refused to cash it. Why?

Tom asked his father what he should do with the check. Mr. Logan said, "First sign your name on the back of the check. Then give it to me, and I will get it cashed for you at the bank. When you sign your name on the back, write it in exactly the form that Mr. Wiley used on the front of the check."





8. When Tom signed his name on the back of the check, he *endorsed* the check. The picture above shows how Tom endorsed the check. Why did he write his name as *Thomas Logan* instead of *Tom Logan?*

9. As soon as a check has been endorsed, it may be cashed by any person who has it. You should not endorse a check until you are ready to give it to the bank or to the person who is going to cash it. Why?

10. Before Mr. Logan could cash Tom's check, he had to sign his name under Tom's name. Why?

Think before You Answer

1. What things on a check should you look at carefully before you accept it?

2. Why is it not wise to cash a check for someone you do not know?

3. Which would be worse, to lose a check before it has been endorsed or after it has been endorsed? Why?

4. Why should a check be written with ink instead of with pencil?

A Family's Business Affairs for a Day

Mr. Poole was in Cleveland on a business trip. On Monday morning he telephoned his wife in Chicago to tell her that he would be delayed for two days more. He asked her to send him $25 immediately.

Mrs. Poole knew that a check, money order, or registered letter might not reach him until the next day. So she went to the telegraph office and gave the operator the money to "wire" to Mr. Poole. The operator sent a telegram to the Cleveland office telling it to give Mr. Poole $25. She charged Mrs. Poole a fee of 80¢ and collected a government tax of 14¢.

1. How much did Mrs. Poole pay in all?

2. The 80¢ fee was about what per cent of the $25?

3. If Mr. Poole had been in New York City, the fee would have been $1.03 and the tax 20¢. To send the $25 to New York City would have cost how much more than to send it to Cleveland?

4. The $1.03 fee from Chicago to New York City is about what per cent of $25?

5. That same day Mrs. Poole bought a $6 hat on sale at a 25% discount. Find the sale price.

6. That afternoon Ann Poole returned a blouse she had bought two days before at the Economy Store. Ann had a receipt showing that she had paid $3.75 plus 8¢ tax for the blouse. The clerk gave her back all the money she had paid for it. How much money did the clerk give back to Ann?

7. Should Ann have written this amount in her cash-account book as a receipt or as an expenditure? Why?

8. Mrs. Poole paid the electric bill on Monday. The gross bill was \$3.83, and she received a discount of \$.38. This was a discount of about __%.

9. Mrs. Poole paid the net amount of the bill. How much did she pay?

10. Also on Monday, Mrs. Poole ordered 2 mattress covers priced at \$3.50 each. She figured that she should add 2% to the cost because of the state sales tax. She bought a money order for the total amount. What should the money order fee have been?

11. Monday evening Mrs. Poole figured that the family's operating costs for January and February together totaled \$58.13. She had planned to spend not more than 10% of their monthly income of \$230. Was the total for these two months more or less than she had planned? How much more or less was it?

Learning through Practice

1. Add 179, 919, and 88.

2. 40 is __% of 125.

3. $.550+.004+.908=$

4. Divide 116 by 28.

5. 25% of 625 =

6. $13\frac{5}{12}+28\frac{3}{4}=$

7. $64765 \div 25=$

8. 15.8% of 64 =

9. 45 is __% of 375.

10. $25\frac{1}{3}-17\frac{4}{5}=$

11. $\frac{1}{2}+\frac{2}{5}+\frac{1}{4}+\frac{3}{10}=$

12. Multiply 234.2 by 1.06.

13. $62\frac{1}{2}$% of 3240 =

14. $57.76 \div 3.8=$

15. $1.8 \times .0079=$

16. $75906-8457=$

17. __% of 96 = 16

18. $\frac{1}{4}+\frac{3}{8}+\frac{2}{3}=$

19. $\frac{1}{4}$% of 56 =

20. $12\frac{1}{2}-8\frac{4}{5}=$

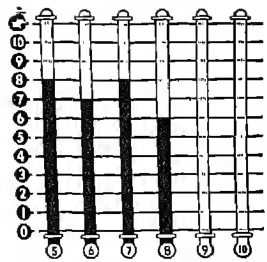
21. 49 = __% of 140

22. 25% of \$98.57 =

23. $6508.19-129.00=$

24. 2.9 is __% of 580.

Self-Testing Drill 9



You will have exactly *20 minutes* for this drill. If you finish before the time is up, try "A Side-Trip in Mathematics" on page 262.

Try to make a score on this drill that will make the thermometer on your Progress Chart go close to the star line.

Example 16 is wrong unless all parts are correct.

1. Subtract:
$$\begin{array}{r} 1018241 \\ \underline{594357} \end{array}$$

2. $25 \div 12\frac{1}{2} =$

3. $.194 + .481 + .432 + .425 + .458 =$

4. $5\frac{1}{3} \div 6\frac{2}{3} =$

5. $8\frac{1}{2} \div 1\frac{7}{10} =$

6. 262 is approximately what per cent of 750? Give your answer to the nearest whole per cent.

7.
$$\begin{array}{r} \$6.98 \\ 8.66 \\ 7.33 \\ 4.67 \\ 5.99 \\ \underline{2.57} \end{array}$$

8. How much larger is $22\frac{2}{5}$ than $18\frac{1}{2}$?

9. Multiply:
$$\begin{array}{r} 846 \\ \underline{321} \end{array}$$

10. $496\overline{)341744}$

11. Find $4\frac{1}{2}\%$ of \$9145.

12. From 2 pk. 3 qt. subtract 1 pk. 5 qt.

13. Find 110% of 240.

14. 57 is __% of 76.

15. What is the interest on \$835 for 3 yr. 8 mo. at 6 per cent?

Go on to the next page.

16. Write on your paper the number that belongs where each question mark is below.

17. Multiply 81.49 by 836.

	FRACTION	DECIMAL	PER CENT
a	$\frac{199}{100}$	1.99	?
b	$\frac{7}{100}$	?	7%
c	?	.60	60%

18. Is 140 equal to 7% of 9.8, 980, 200, or 2000?

19. 7 pk. 2 qt. ÷ 4 =

20. 325 is __% of 1950.

Standards for Self-Testing Drill 9

Number Correct	0	1–3	4–5	6	7	8	9	10	11–12	13–14	15–19	20
Rating	0	1	2	3	4	5	6	7	8	9	10	★

A Side-Trip in Mathematics

There are many methods of multiplication. One of these methods is used below to multiply 21 by 17.

1. You find the 10 in Column A by finding half of 21. Do not use the 1 remainder. How do you find the 5? The 2? The 1?

A	B	C
21	17	17
10	34	68
5	68	272
2	136	357
1	272	

2. How do you find the 34 in Column B? How do you find the other numbers in this column?

3. Find the numbers in Column B opposite odd numbers in Column A. The sum of these numbers is the answer for 17×21. 17×21 = __.

4. Use this method when you multiply below.

53×81	27×40	19×65	31×94	32×57
26×41	35×81	24×44	80×52	34×18

What must I find? Add? Multiply? Shall I subtract? Divide? Why? What numbers shall I use?

Problem Test 5

1. The eastbound Nighthawk Air Express was due in Chicago at 8:15 A.M. It had a strong tail wind that night and arrived in Chicago at 7:05 A.M. How much ahead of scheduled time did it arrive? (3)

2. A slightly used electric pump is offered for sale at a discount of 20% from its regular price of $37.50. What is its sale price? (3)

3. Mary Adams receives a 10% commission for selling advertising space in a newspaper. Find her total commission on the following sales: Varsity Theater, $5.50; Newell's Shoe Store, $4.00; Corner Book Store, $2.75; Johnson's Meat Market, $3.25. (4)

4. Henry's older brother Sam has learned that he will have a good chance to make the football team next year if he can increase his weight 15%. Sam now weighs 120 lb. A 15% increase in weight will bring him up to what weight? (5)

5. Miss King receives $\frac{3}{4}$¢ a pound for packing plain chocolates and 1¢ a pound for packing fancy bonbons. How much should she receive for packing 28 lb. of plain chocolates? For packing 22 lb. of fancy bonbons? (5)

Problem 5 is wrong if either answer is wrong.

6. Last year Mary Jane Elliot worked 700 problems in arithmetic. Of these problems she had 574 correct. What per cent of her last year's arithmetic problems did she have correct? (5)

7. Miss Gray lent $500 to Miss Moore at 6% interest. Miss Moore agreed to pay both the interest and the principal at the end of 2 yr. 6 mo. How much should Miss Moore pay at the end of that time? *(5)*

8. The Speed Airway Lines operates a daily airplane from Newark, N. J., to Oakland, Cal. The average cost per trip is $2000. The average profit per trip is $375. To the nearest whole per cent, the profit is what per cent of the cost? *(6)*

9. Tom Harris walked from Bufton's Corner to Melvin Village in 4 hr. 40 min., or $4\frac{2}{3}$ hr. The distance is 14 miles. How many miles an hour did Tom average? *(6)*

10. Mr. Cary kept a record of the cost of rearing his son Lee to the age of 16. During that time a total of $3200 was spent on Lee. Of this amount $1430 was spent for food. To the nearest tenth of a per cent, what per cent of the total was spent for food? *(7)*

11. An agent sold 85 baskets of apples to a grocer at 95¢ a basket. The agent's commission was $6.46. What rate of commission did the agent charge? *(8)*

12. In the first trial, Jim's record in the running broad jump was 18 ft. 4 in. Only one other boy in the first trial beat this record. In order to beat the other boy's record, Jim must increase his own record by 10% in the final trial. How far must he jump in the final trial to do this? *(8)*

Standards for Problem Test 5

Poor	Fair	Average	Good	Excellent
0–7	8–16	17–34	35–49	50–65

Telephone BEACON 7095

PIONEER FUEL COMPANY

459 Front Street, Portland 3, Oregon

Jan. 2, 1948

Mr. John C. Manning
809 Oak Street

Month	Date	Commodity		
Nov.	30	Balance due	10	90
Dec.	21	Load of wood	8	45
		TOTAL	19	35

KEEP THIS BILL. YOUR CHECK IS YOUR RECEIPT.

Bills and Receipts

Jack Manning was elected treasurer of the Arts and Crafts Club. His duties were to make out bills, to collect all club dues, and to keep all accounts.

Jack had never made out a bill; so he asked his mother to let him examine some of her old bills. He found that there were many different kinds of bills and also that they were usually sent out on or near the first of the month. The first bill that Jack examined is shown above.

1. How much did Mr. Manning owe the Pioneer Fuel Company on Jan. 2, 1948?

2. How do you know from this bill that Mr. Manning had not paid all of his November bill? What did he buy from the Pioneer Fuel Company during December?

3. Mr. Manning mailed a check in payment of this bill. What should he have written on the check after the words *pay to the order of*? What amount should he have written on the check?

EVERY SERVICE THE MOTORIST REQUIRES

MIDWAY GARAGE

2510-12 EAST 6TH STREET

PHONE GARFI

Portland, 2, Ore., Oct. 1,

Mr. John C. Manning

809 Oak Street

DATE				
Sept.	4	1 Heavy Duty Tire	$16	16
Sept.	4	Wash and Polish	1	00
Sept.	24	1 Defroster	3	00
		Labor		75

Paid in Full Oct. 4, 1947 OMK

Whenever you pay a bill, you should usually get a *receipt* from the person to whom you make payment. A receipt is a written statement saying that the money in payment of a bill has been received.

4. When Mr. Manning's check was received by the Pioneer Fuel Company, they endorsed it and cashed it. The bank returned the check to Mr. Manning after it had been cashed. He kept it as a receipt. How could the check prove that he had paid the bill?

5. The next bill that Jack saw is shown above. Study it carefully; then answer the questions that follow. To whom was the bill sent? To whom was it owed?

6. How do you know from this bill that Mr. Manning did not owe the garage anything on Sept. 1, 1947?

7. When was this bill made out? How do you know?

8. Mr. Manning went to the garage and paid the bill in cash to the office girl. He asked for a receipt; so the girl wrote on the bill "Paid in Full, Oct. 4, 1947," and signed her initials. Why did she sign her initials? On what date was the bill paid?

The office girl *receipted* Mr. Manning's bill. The person who receipts a bill should write on it *Paid, Paid in full,* or *Payment received.* Then he should write the date and his signature or initials.

9. If Mr. Manning had paid only \$5 on the bill, why should the office girl have written on it *Payment of \$5 received* instead of *Paid in full?*

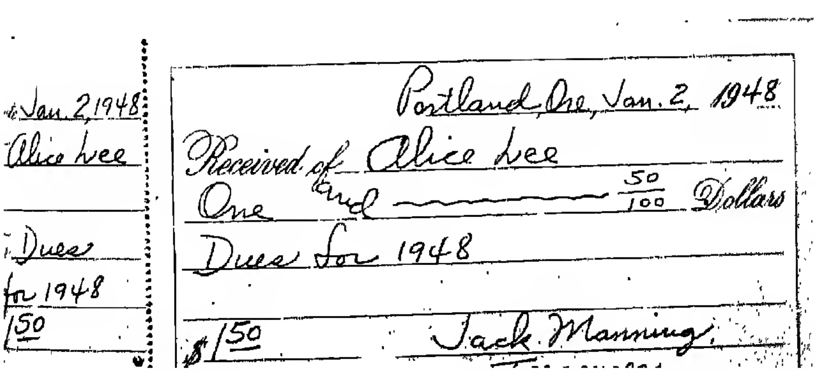
10. How should you receipt a bill for \$56.10 that has been paid in full? How should you receipt it if only \$40 has been paid on it?

11. Jack decided to write *Jack Manning, Treasurer,* when he signed receipts for club dues. Why would this be better than signing them *Jack Manning?*

Before Jack sent out any bills for dues, Alice Lee paid him \$1.50 for her dues. Dick Martin, who had been treasurer the year before, showed Jack how to make out Alice's receipt. The receipt is shown below.

The part of the receipt at the left of the dotted line is the *stub.* Jack kept the stub in his receipt book as a record. He gave the other part to Alice.

12. In what city and state does Jack live? Alice paid her dues on what date? How many times did Jack write the amount paid on Alice's receipt?


Jan. 2, 1948
Alice Lee
Dues
for 1948
1 50

Portland, Ore., Jan. 2, 1948
Received of Alice Lee
One and 50/100 Dollars
Dues for 1948
\$1 50 Jack Manning,

13. How does the receipt on page 267 show the purpose for which Alice paid the $1.50?

14. Does the stub tell you everything that the receipt tells you? If Jack should get his records mixed up, how could Alice prove that she had paid her dues?

15. If Jack had sent Alice a bill and she had brought it with her when she paid her dues, in what other way could he have made a receipt for her?

Sales Slips and Monthly Statements

Jack found a number of bills fastened with a paper clip. Two of these bills are shown at the bottom of page 269. His mother told him that these were *sales slips*. She said that each time she bought groceries or meat at the Central Grocery and Market, the clerk wrote a sales slip showing each item that she bought and its price. This sales slip was *itemized*.

1. By using a piece of carbon paper, the clerk at the same time made a copy of the itemized sales slip. He kept the original sales slip for the store's record and gave the carbon copy to Mrs. Manning. Why did the store need the original sales slip?

2. Mrs. Manning told Jack that she always kept the sales slips until she paid the monthly bill. Why did she keep these sales slips?

3. Look at the first sales slip. The groceries and meat listed were bought on what date?

Before Mrs. Manning bought these groceries, she owed the Central Grocery and Market $33.54. This amount is written opposite *amount forwarded*, which means *amount brought forward*.

4. Where did the clerk write the total amount of the Oct. 27 purchases? He added this total to what other amount? Why did he do this?

5. Now examine the second sales slip below. Why was $36.92 written opposite *amount forwarded?*

6. Had Mrs. Manning bought anything at the Central Grocery and Market on Oct. 28? How do you know?

7. What should the clerk have written as the total of Mrs. Manning's purchases on Oct. 29?

8. What should he have written as the total amount she owed on Oct. 29?

CENTRAL GROCERY & MARKET

Phone Broadway 2418 Broadway at Mill St.

Portland, Ore., Oct. 27, 1945

Mrs. John C. Manning

No. 809 Oak St.

	Amount Forwarded →			33	54
1	2 bread @ 9¢		18		
2	3 Cans tomatoes @ 14¢		42		
3	1 lb. cheese		32		
4	1 pt. salad dressing		37		
5	1 doz. eggs		55		
6	1 lb. bacon		58		
7	2 bunches celery @ 15¢		30		
8	2 lb. round steak @ 33¢		66	3	38
9				36	92
10					

Save this slip. It is the only itemized bill you will receive.

CENTRAL GROCERY & MARKET

Phone Broadway 2418 Broadway at Mill St.

Portland, Ore., Oct. 29, 1945

Mrs. John C. Manning

No. 809 Oak St.

	Amount Forwarded →			36	92
1	1½ doz. rolls @ 12¢		18		
2	2 green peppers @ 5¢		10		
3	1 can corn		13		
4	3 lemon gelatin @ 10¢		30		
5	1 pk. Red potatoes		60		
6	10 lb. sugar		76		
7	2 lb. green beans @ 19¢		38		
8	5 lb. rib roast @ 29¢	1	45		
9	2 lb. lard @ 18¢		36		
10					

Save this slip. It is the only itemized bill you will receive.

STATEMENT

Phone BROADWAY 2418 PORTLAND 2, ORE., Nov. 1, 19

CENTRAL GROCERY AND MARKET
Broadway at Mill St.

Sold To

Mrs. John C. Manning
809 Oak Street
City

Nov. 1	Balance due PAID CENTRAL GROCERY AND MARKET		41

9. The *statement* above was sent to Mrs. Manning by whom? It was sent on what date? How do you know that she did not buy anything at this store on Oct. 30 and Oct. 31?

10. How do you know that Mrs. Manning paid this bill? She paid it on what date?

11. The clerk who received her money used a rubber stamp to receipt the statement. Why did he write his initials over the stamp? What reason might the store have for using the rubber stamp to receipt bills?

Practice in Areas

Find the area of each rectangle whose dimensions are given below.

1. 15 ft. x 18 ft.

2. 8 in. x 13 ft. 6 in.

3. $5\frac{1}{2}$ mi. x $6\frac{2}{3}$ mi.

4. 28 ft. x 19 yd.

5. 5.4 ft. x 11.7 ft.

6. 10 in. x 2 yd. 1 ft.

7. 1320 ft. x $\frac{1}{2}$ mi.

8. 5′ 8″ x 5′ 8″

9. 18 in. x $1\frac{1}{4}$ yd.

10. 440 yd. x $1\frac{1}{2}$ mi.

Problems about Bills and Receipts

1. On October 1, 1945, Mr. Robert R. Carey owed the Star Drug Store a balance of $3.45. During October he bought $2.36 worth of drugs and supplies. Make out a bill for these amounts like the one on page 265. Date it November 1, 1945. Make up any information you need, such as phone number and addresses.

2. Make a sales slip for Mrs. John C. Manning like the ones on page 269. Date it November 10, 1945, and show $6.15 as the amount forwarded. Show the following purchases on the slip: 2 doz. rolls at 18¢ per dozen; 1 head lettuce, 15¢; 5 lb. sugar, 33¢; $3\frac{1}{2}$ lb. oranges at 12¢ per pound; 2 packages cereal at 12¢ per package. Show the total amount for this sales slip and the amount to be forwarded to the next slip.

3. Mrs. Manning bought a total of $34.16 worth of groceries and meat at the Central Grocery and Market during November, 1945. Make out a monthly statement for this amount like the one on page 270. Receipt this statement as though it had been paid on December 3, 1945.

4. Make out a receipt for club dues like the one shown on page 267. Show that Jerry Harper paid a total of 25¢ for dues in the Outdoor Club for May and June on July 2, 1945. Sign your name as treasurer of the club.

5. Make a receipt showing that Mr. John C. Manning paid the Western Realty Company $65 in cash on Jan. 3, 1945. The payment was for January rent on a house located at 809 Oak Street, Portland, Oregon.

6. Make out a sales slip showing the following: amount forwarded, \$8.33; 4 yd. chambray at 58¢ per yard; 2 pair heavy woolen socks at 98¢ per pair; 1 pair overalls at \$1.47 per pair; 2 pair work gloves at \$1.29 per pair; 1 work shirt at \$1.39. Make up all other information that you need, such as names, dates, and addresses.

7. Make out a monthly statement for March, 1945, which shows a balance of \$4.19 brought forward from February, 1945, and total purchases of \$28.76 for March, 1945. Receipt this statement as though it had been paid on April 4, 1945. Make up all other information you need.

8. Some stores give only *cash-register receipts.* Would such stores ever need to send out monthly bills or statements? How do you know?

Without Pencil

	A	B	C	D	E	F
1.	3 yd. 9 in. 4 yd. 8 in. 5 yd. 9 in.	$2\frac{2}{5} \times \frac{5}{6}$	Which is more, $\frac{1}{2}$ of $\frac{1}{2}$ or $\frac{1}{3}$ of $\frac{1}{3}$?	.134 = ---- %	$16\frac{2}{3}$ % of \$600 = \$-----	$\frac{1}{6} \div \frac{1}{4}$
2.	128 in. = ---- ft.	13.5−2.6	$7\frac{2}{3}$ $\frac{1}{6}$ $1\frac{1}{3}$	110 % of 200 = ---	5 lb. 8 oz. = --- oz.	Multiply: 400 .5
3.	2 is ---% of 10.	7.5 % = what decimal fraction?	$.9\overline{)6408}$	Find the average: 20, 40, 50, 10.	Subtract: 16 $7\frac{5}{8}$	1 % interest on \$200 for 6 mo. is \$-----
4.	$\frac{3}{4} \div 2\frac{1}{2}$	Subtract: \$67.95 1.56	Add: 708 402	60 is ---% of 30.	$2\frac{1}{2}$ hr. = ---- min.	$26\overline{)263}$

Problems about Buying

1. Mrs. Nelson bought 1 jar of peanut butter that was on sale at 3 jars for \$1. How much should she have paid for the jar of peanut butter?

In Problem 1 why is the answer 34¢ instead of 33¢?

2. Mrs. Nelson saw oranges on sale at 10 lb. for 89¢. She wanted only 5 lb. How much should she have paid for 5 lb.?

5 lb. are __ of 10 lb. 5 lb. will cost __ of 89¢, or __¢.

3. Mrs. Nelson wanted 6 bunches of beets. They were priced at 2 bunches for 15¢. How much would she have had to pay for 6 bunches?

Why can you find the answer for Problem 3 by multiplying 15¢ by 3?

4. Pears were priced at 2 lb. for 25¢. Mrs. Nelson told the clerk she wanted 75¢ worth of pears. How many pounds of pears should he have given her?

75¢ is __ times 25¢. What do you do next to find the answer for Problem 4?

5. At the rate of 5 cans of tomato juice for \$1, how many cans could Mrs. Nelson buy for 80¢?

80¢ is $\frac{80}{100}$, or __, of \$1. 80¢ will buy $\frac{4}{5}$ of 5, or __ cans of tomato juice.

6. Flour was priced at \$4.80 per 100 lb. At that rate, what would Mrs. Nelson have to pay for 50 lb. of flour?

7. At \$4.80 per 100 lb., what would Mrs. Nelson have to pay for 75 lb. of flour?

8. At 6 for 25¢, 15 apples will cost __¢.

Making Change

Study the pictures on the next page. They describe a situation like one that may happen when you and some friends buy things together and have to make change. Sometimes it is difficult to make change, but it usually can be done if you use your head.

1. In Picture 1 why did George give the cashier the 4 pennies? When he counted his change, why did he begin counting with $1.50? What coin did he count first? How do you know that George had two $1 bills, a nickel, and 4 pennies to begin with?

2. Why did Don offer to pay for himself and Ed in Picture 2? Why did he give George 2 pennies?

3. What did George mean in Picture 3 when he said, "All I have to do is give you change for 85¢ out of $1"?

4. You can figure out from the pictures how much money Ed and Don had to start with. How much did each boy have?

5. What bills and coins did each of the three boys have to start with?

6. Look at Pictures 5 and 6 again. Were the boys wise to count their money? Why?

7. How much money should each of the three boys have had when they finished making change?

8. What coins did each have?

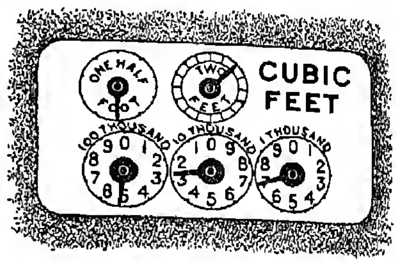
9. Suppose that, after George had paid the whole bill, Don had given him 3 pennies and a dollar bill. Could George have given Don the correct change? Explain your answer.


THE BILL FOR OUR THREE LUNCHES WAS $1.44. I GAVE THE CASHIER TWO $1 BILLS AND 4 PENNIES. LET'S SEE -- $1.50, $2. NOW I HAVE A NICKEL AND A DIME AND A HALF DOLLAR.
I OWE YOU 38¢, GEORGE. AND ED OWES YOU 49¢. ALL THE MONEY I HAVE IS A DOLLAR BILL, A QUARTER, AND THREE PENNIES. CAN YOU MAKE THE CHANGE?
NO, I CAN'T.
I HAVE ONLY A NICKEL, 2 DIMES, AND A HALF DOLLAR.
WELL, GEORGE, I CAN PAY FOR BOTH ED AND ME. HERE ARE A DOLLAR BILL AND 2 PENNIES. YOU CAN GIVE ME THE RIGHT CHANGE FOR THAT, CAN'T YOU?
YES. ALL I HAVE TO DO IS GIVE YOU CHANGE FOR 85¢ OUT OF A DOLLAR. HERE'S A NICKEL AND A DIME.
NOW I HAVE A QUARTER, A DIME, A NICKEL, AND A PENNY. I'LL COLLECT FROM ED.
HERE'S A HALF DOLLAR.
AND HERE'S YOUR PENNY CHANGE.
I'M ALL MIXED UP. EVERYBODY HAS PAID EVERYBODY ELSE. HOW DO WE KNOW WE HAVEN'T MADE A MISTAKE?
THAT'S EASY. I KNOW HOW MUCH I HAD TO START WITH, AND I KNOW HOW MUCH MY LUNCH COST. SO I CAN FIND OUT IF I HAVE THE CORRECT AMOUNT NOW.
THEN I SHOULD HAVE $2.09 MINUS 57¢, OR $1.52, AND I DO.
MY MONEY IS RIGHT, TOO. SINCE MY MONEY IS RIGHT AND YOURS IS RIGHT, DON'S MONEY IS PRETTY SURE TO BE RIGHT.

Reading Gas and Electric Meters

Every other month Mr. Barnum "reads" his gas and electric meters and sends his readings to the companies so that his bills can be figured. Employees of the companies read his meters for the other months.

Gas meters measure the amount of gas used in *cubic feet*. Electric meters measure the amount of electric current used in *kilowatt hours*.



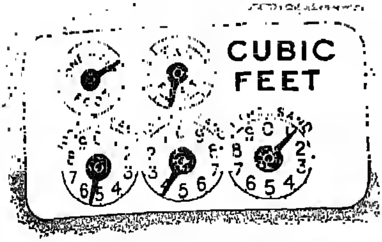
At the right are the dials on a gas meter. The hands on the dials turn when gas is used. The two top dials are test dials. You do not read these two dials.

1. Each of the three lower dials is numbered from 0 to 9. The numbers on each of these dials are arranged according to the direction in which the hand turns. Which hands turn in the same direction as the hands of a clock? Which hand turns the other way?

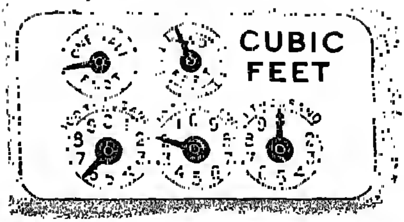
2. Find the dial marked *1 thousand*. Each time the hand turns all the way around this dial, 1000 cubic feet of gas are used. How much gas is used when the hand turns from one figure to the next? The figures on this dial mean *hundreds* of cubic feet. There is no dial for *tens* or *ones*.

3. Each time the hand on the 1000 dial turns all the way around, the hand on the dial marked *10 thousand* turns from one figure to the next. Find this dial. The figures on it mean *thousands* of cubic feet.

MAY READING



JUNE READING



4. What happens to the *100 thousand* dial when the hand on the 10 thousand dial turns around once? The figures on the 100 thousand dial mean *ten thousands.*

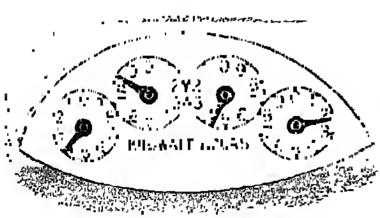
5. To read a gas meter, start with the left-hand dial. Read the last figure the hand has reached or passed. Do the same for each of the other two dials, keeping each figure in its proper place. You must put two zeros at the right of your figures. Why?

6. The meter on page 276 reads __ cubic feet.

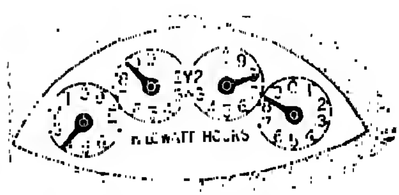
7. Find the difference between the two readings of the gas meter above. This difference is the amount of gas used during the time between the two readings.

To read an electric meter, first see in which direction each hand turns. Starting with the left-hand dial, read the last figure that each hand has reached or passed. Keep each figure in its proper place.

8. The picture below shows an electric meter as it looked in May and in June. The reading for May was 3842 kilowatt hours. What was the reading for June? __ kilowatt hours of electricity had been used.



MAY READING



JUNE READING

9. The pictures at the bottom of this page show the dials of the Barnum family's electric and gas meters on July 1 and August 1. How many kilowatt hours of electric current were used during July?

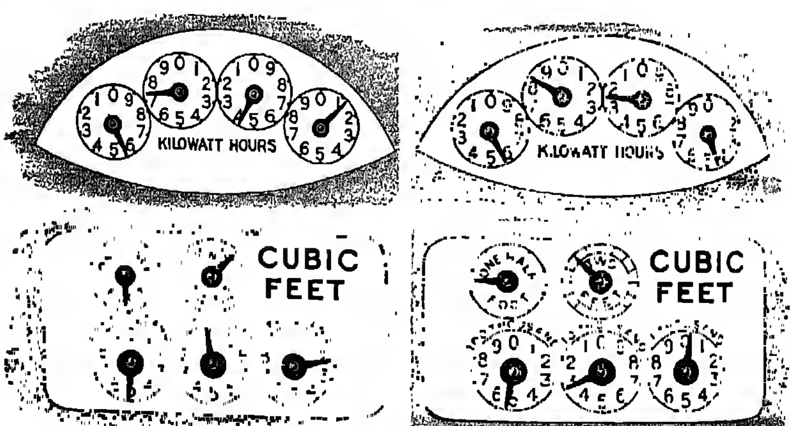
10. The Electric Service Co. charged the following rates: first 30 kilowatt hours @ 9¢; next 30 kilowatt hours @ 7¢; remaining kilowatt hours @ 3¢; discount of $\frac{1}{2}$¢ per kilowatt hour for payment within 10 days. How much should the Barnums' net electricity bill for the month have been?

11. How many cubic feet of gas were used by the Barnum family during July?

12. The gas company charged 20¢ per 100 cubic feet for the first 500 cubic feet and 12¢ per 100 cubic feet for the next 3000 cubic feet. What should the Barnums' gas bill have been for the month of July?

13. If the bill is not paid in 10 days, 5% is added. Find the amount of the bill if it is paid in 12 days.

14. On Sept. 1 the Barnum family's meter readings were 56,400 cu. ft. and 5946 kilowatt hours. How much will it take to pay both bills on Sept. 6?



JULY 1 AUGUST 1

Problems for Good Thinkers

1. Mr. Hale loaned Mr. Ansel $120 at 6% interest. Mr. Ansel paid back the loan within one year in 12 monthly payments of $10 each plus interest. He paid Mr. Hale $123.90 in all. Why did he pay only $3.90 interest during the year instead of $7.20?

2. What was the total amount of Mr. Ansel's first monthly payment? What was the total amount of his second monthly payment?

3. What was the total amount of Mr. Ansel's last monthly payment?

4. Mr. Hale's gas bill for October was $4.68. He said that his November gas bill showed an increase of 125%. Is such an increase possible? If so, how much was his November bill?

5. Could Mr. Hale's December gas bill have shown a decrease of 125% from his November bill? Explain your answer.

6. Bob's savings in June amounted to $12. His July savings amounted to an increase of 25% over his June savings. How much did he save in July?

7. At the end of June, Margaret's total savings were $12. At the end of July, her savings had increased to 125% of the amount she had at the end of June. How much did she save in July?

8. Do you know how much Bob had in savings at the end of July? Why?

9. Do you know how much Margaret had in savings at the end of July? Why?

Using Formulas

You learned on page 206 that you can use a formula to find interest. There are many other formulas in mathematics. Three of them are explained below.

$A = lw$

$A = s^2$

$P = 4s$

1. $A=lw$ is the formula for finding the area of a rectangle. The letter A stands for *area*, and l stands for *length*. What does w stand for?

2. To find the area of a rectangle 12′ long and 8′ wide, using the formula $A=lw$, you put 12 in place of l. Why? What do you put in place of w? What sign do you put between 12 and 8? What is the area of this rectangle?

3. The second formula at the right above is used to find the area of a square. Read it $A=s$ *square*. s^2 means $s \times s$. The letter s stands for side. The raised 2 means that a side of the square is to be multiplied by itself. Use the formula to find the area of a 7-ft. square.

4. $P=4s$ is the formula for finding the perimeter of a square. What does the letter P stand for? What does the letter s stand for? Use $P=4s$ to find the perimeter of a 7-ft. square.

5. Can the formula $P=4s$ be used to find the perimeter of any rectangle? Why or why not?

Use formulas to solve the problems below.

6. Find 6% interest on $130 for 9 mo.

7. The perimeter of a $3\frac{1}{2}$-ft. square is __ ft.

8. The area of a $9\frac{1}{2}$-ft. square is __ sq. ft.

9. Find the area of a rectangle that is 8′ x 11′.

Thinking about Measures

The English system of weights, which is used in the United States and England, was originally based on the weight of a grain of wheat.

1. When this unit was first used, it was required that the grain of wheat be "dry and round and from the middle of the ear." Why?

2. Why was this unit of measure exact enough for the people who first used it?

3. This unit of measure is now equal to .0648 gram. It is still called the *grain*. Why?

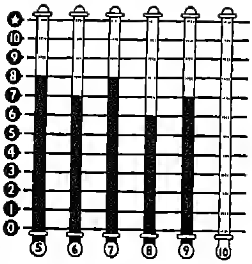
4. The pound that we use to measure everything except precious stones, precious metals, and drugs is equal to 7000 grains. This is the *avoirdupois pound.* How many grains are there in an avoirdupois ounce?

5. Workers who weigh precious stones and metals use the *troy pound.* It is equal to 5760 grains. It is how many grains lighter than the avoirdupois pound?

6. There are 12 troy ounces in a troy pound, and each ounce is divided into 20 *pennyweights.* How many grains are there in a troy ounce?

7. Druggists use the *apothecaries' pound*, which is equal to 5760 grains and is divided into 12 ounces, like the troy pound. But the apothecaries' ounce is divided into 8 *drams*, and each dram is divided into 3 *scruples*. Think of a reason for dividing the troy ounce differently from the apothecaries' ounce.

8. Why is it not correct to say that an avoirdupois pound is 4 ounces heavier than a troy pound?



Self-Testing Drill 10

You will have exactly *20 minutes* for this drill. If you finish before the time is up, try "A Side-Trip in Mathematics" on page 283.

1.
5651
8737
34
4167
3656

2. Subtract:
1324512
485410

3. Multiply:
268
706

4. Find the difference:
.099235
.023589

5. $14-6\frac{1}{6}=$

6. $465\overline{)264120}$

7.
$2\frac{11}{12}$
$5\frac{3}{4}$
$3\frac{3}{8}$

8. Multiply:
586.79
.45

9. $3\frac{5}{12}\div 1\frac{3}{8}=$

10. $5.691\overline{).45}$

11. Find the average:
.323
9.765
.877
4.884
4.146

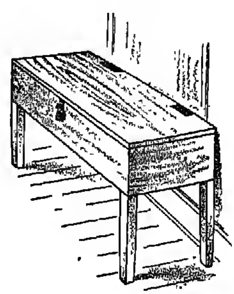
12. What must be added to 2482′ to make a mile?

13. Find 125% of 364.

14. 3 yd. 1 ft. $\div$ 2 =

15. 144 is what per cent of 96?

16. At the right is a picture of a locker in the captain's cabin on a freighter. Find the inside area of the bottom of this locker. The inside dimensions of the bottom are 32″ by 70″.



17. Find the average:

5.47
4.73
1.28
6.69
6.68

18. 649 is __% of 2140.

19. (*a*) 1.75 of a number is what per cent of the number?

(*b*) $4\frac{1}{4}\%$ of a number is what decimal fraction of the number?

(*c*) $83\frac{1}{3}\%$ of a number is what common fraction of the number?

20. In 3 yr. 4 mo. how much interest will \$8575 earn at $4\frac{1}{2}\%$?

Example 19 is wrong if you have any part wrong.

Standards for Self-Testing Drill 10

Number Correct	0	1–3	4–5	6	7	8	9	10	11–12	13	14–19	20
Rating	0	1	2	3	4	5	6	7	8	9	10	★

A Side-Trip in Mathematics

Bankers use a convenient short cut to find 6% interest on any principal for 2 mo., or 60 da. They move the decimal point in the principal two places to the left.

1. If you use this short cut, is 6% interest on \$500 for 60 da. \$50, \$5, or \$.50? How do you know?

2. You can find 6% interest on \$500 for 30 da. by finding $\frac{1}{2}$ of \$5. Why?

3. Why can you find 6% interest on \$500 for 90 da. by finding $1\frac{1}{2}$ times \$5?

4. How can you use the short cut to find 6% interest on \$500 for 120 da.?

5. Find 6% interest for 15 da. on \$1200.

6. Find 6% interest for 20 da. on \$1500.

Doctor Mead's Bills

1. Each month Dr. Mead's daughter Ann makes out his bills. He pays her a commission of $\frac{1}{4}\%$ of the total amount of the bills. During three months she made out bills as follows: October, \$642; November, \$524; December, \$689. Find the amount of her commission for each of these months. Find it for all three months.

2. Last year Ann made out bills totaling \$7542. At a commission of $\frac{1}{4}\%$, how much did she earn?

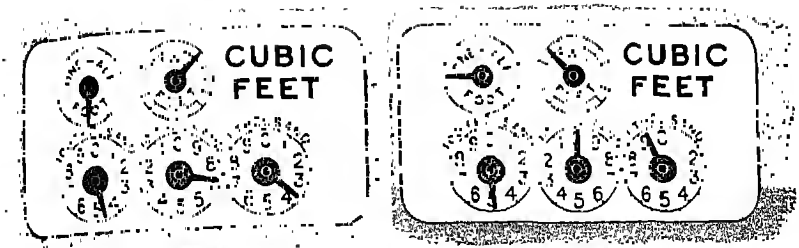
3. A bill for medical supplies, amounting to \$67.36, was marked "15%, 30 days." What was the net amount of this bill if paid within the time limit?

4. A bill for office equipment amounted to \$678.95. A notice on the bill said that 50% of it could be paid on Dec. 1, 25% on Jan. 1, 15% on Feb. 1, and the balance on Mar. 1. What per cent was due Mar. 1?

5. Ann figured that her father should pay \$339.47 on Dec. 1, \$169.73 on Jan. 1, \$101.84 on Feb. 1, and \$67.91 on Mar. 1. Dr. Mead figured that he should pay \$339.48 on Dec. 1, \$169.74 on Jan. 1, \$101.84 on Feb. 1, and \$67.89 on Mar. 1. How did Ann and her father figure so that they got different amounts for Dec. 1, Jan. 1, and Mar. 1? Why were their amounts for Feb. 1 the same?

6. Did it matter whether the bill was paid according to Ann's figures or according to her father's? Why?

7. Dr. Mead paid a bill amounting to \$184.50 by postal money order. How many money orders did he have to buy? How much was the total fee for these money orders? Use the table on page 254.



8. Ann mailed a package valued at $25 for her father. It weighed 8 oz., and Ann paid postage at 3¢ per ounce, the registry fee as given in the table on page 253, and 4¢ for a return receipt. What was the total cost of mailing this package?

9. Use the two readings of the gas meter above to figure Dr. Mead's gross bill for the month ending July 5. The gas company charged 22¢ per 100 cubic feet for the first 500 cubic feet and 14¢ per 100 cubic feet for the next 2500 cubic feet.

10. The gas bill showed that a 10% discount would be given for prompt payment. Find the amount of the net bill.

Think before You Answer

1. One side of a square is 25% of the perimeter of the square. Why? In a rectangle 4 ft. wide and 8 ft. long, is the width of the rectangle 25% of its perimeter? How do you know?

2. Would you save more by a discount of $\frac{3}{4}$% or a discount of 1¢ on each dollar? Why?

3. Which is better, to let the bank add interest to your account or for you to withdraw the interest? Explain your answer.

Learning through Practice

1. $159+79+60+48=$
2. 2.5% of $687=$
3. $16\times1\frac{1}{10}=$
4. $\frac{4}{5}+\frac{7}{10}+\frac{3}{5}+\frac{1}{2}=$
5. $98\div28=$
6. $107641-68397=$
7. $39\times516=$
8. 12 is __% of 300.
9. $8\frac{9}{10}-5\frac{3}{10}=$
10. $9284.34-5784.89=$
11. $634.8\div92=$
12. $\frac{9}{16}\div2\frac{5}{8}=$
13. $70.11\div.95=$
14. $\frac{7}{8}+\frac{11}{16}+\frac{5}{16}=$
15. $.6\div74=$
16. __% of 328 is 41.
17. $458+819+759+871=$
18. $9\div\frac{1}{16}=$
19. $\frac{1}{2}\%$ of $1200=$
20. $187\frac{1}{2}\%$ of $\$144=$
21. $33\frac{1}{3}\%$ of $\$7.50$ is $\$$__.
22. $.80+5.90+8.06=$
23. $.72\times825=$
24. $94.4\div32=$
25. 16 is __% of 80.
26. __% of $\$.56$ is $\$.28$.

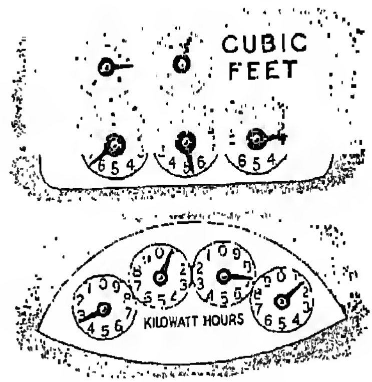
Without Pencil

	A	B	C	D	E	F
1.	Multiply 37 by 15.	$5\frac{1}{2}$ lb. = ---- oz.	Subtract: $\$12.05$ 5.75	.032 = ---- %	4 × 6 × 5	$\frac{1}{3}+\frac{11}{12}$
2.	$\$.02$ .04 .04 .06	$\frac{1}{6}\div\frac{5}{12}$	75 is ---% of 300.	$7\overline{)28895}$	24000 ÷ 6000	4.8% = what decimal?
3.	1.45 = ----- %	4 A. = --- sq. rd.	Subtract: $13\frac{3}{4}$ $\frac{7}{10}$	2 meters are about ---- in.	Perimeter of a rectangle $4'$ by $4\frac{1}{2}'$ is -----.	$6\overline{)814}$
4.	$\frac{9}{10}\times\frac{1}{12}$	$12\frac{1}{2}\%$ of $\$800$ = -------	10 bu. = ---- qt.	Multiply: 98.5 .6	$\frac{1}{2}\times\frac{1}{4}\times\frac{1}{8}$	105% = what decimal?

Checking Up

If you can do the work on this page and the next page, you are ready for Chapter 6.

1. Write *17 hundred-thousandths* in figures as a decimal. Write *678 millionths* in figures as a decimal. Write *40 and 4 hundredths* in figures.
2. Change 64%, 5.9%, and $\frac{4}{5}$% to decimal fractions.
3. Change .008, .34, 1.37, and 3.2 to per cents.
4. Is $\frac{367}{741}$ approximately $\frac{1}{2}$ or approximately $\frac{1}{3}$?
5. What would you write on a bill to show that the entire amount of it had been paid to you today?
6. Name three safe ways to send money.
7. Write the reading of this gas meter.
8. Write the reading of this electric meter.



9. *Equivalent* means —.
10. 75 is —% of 90.
11. 840 is —% of 700.
12. Find 4% interest on $365 for 27 mo.
13. Find the net amount of a bill for $87 with a discount of $16\frac{2}{3}$%.
14. Mr. May measured to .0001 in. Mr. Scott measured to .00001 in. Which man measured more exactly?
15. Which is heavier, 100 pounds or 45 kilograms?
16. Find a commission of 17% on sales of $280.

17. One inch is what decimal fraction of one yard? Of one foot?

18. Is 1 sq. in. more than or less than 1% of 1 sq. ft.? How do you know?

19. Is 800 lb. more than or less than 25% of 1 T.?

20. Find the area of a rectangle 9′ 6″ by 4′.

21. $i = prt$ is the formula for finding what?

22. Write the formula for finding the perimeter of a square.

23. Does the sum of the following fractions represent more than, less than, or all of something: $\frac{1}{6}$, $\frac{1}{3}$, $\frac{1}{2}$, $\frac{1}{5}$?

24. Does the sum of the following per cents represent more than, less than, or all of something: 8%, 19%, 23%, 30%, 4%?

25. A 40% discount on \$85 amounts to \$__. A 5% commission on \$640 equals \$__.

26. Write the per cents below as decimals.

$\frac{7}{8}\%$ $66\frac{2}{3}\%$ $183\frac{1}{3}\%$ $\frac{2}{5}\%$ $\frac{1}{10}\%$ $119\frac{1}{2}\%$

27. What per cents are equivalent to the fractions below?

$\frac{1}{8}$ $\frac{2}{3}$ $\frac{5}{6}$ $\frac{3}{8}$ $\frac{1}{4}$ $\frac{1}{3}$ $\frac{7}{8}$ $\frac{1}{6}$ $\frac{5}{8}$

28. Compare 648 with 864 by finding what per cent 648 is of 864.

29. Where could you put a decimal point in 12% without omitting the per cent sign?

30. 40 is __% of 20.

31. $.66\frac{2}{3}$ of 2400 is __.

32. $\frac{7}{8}$ of 2176 is __.

33. $\frac{1}{4}\%$ of 470 is __.

34. 2.7 is __% of 8.1.

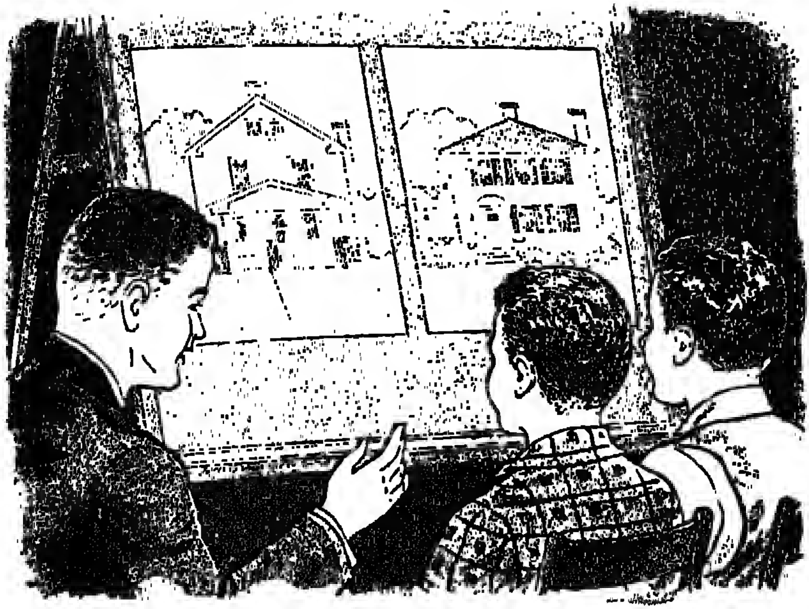
35. 400% of 139 is __.

36. __% of 420 is 168.

37. $12\frac{1}{2}\%$ of \$640 is \$__.

38. 300% of 300 is __.

39. $\frac{1}{2}\%$ of 300 is __.



CHAPTER 6

Improving the Family's Surroundings

Making the Home a Better Place to Live In

The Blairs are planning some improvements in their home. They hope to improve the appearance of the outside of the house, to change the landscaping, and to make some of the rooms more attractive. The Blairs do not want to waste time, effort, or money; so they are making careful plans before they change anything.

In the picture Mr. Blair, Don, and Jimmy are looking at two sketches that Mr. Blair made before remodeling his house. One sketch shows the front of the house before it was remodeled. The other shows how it looked after it was remodeled.

The Blairs are improving their home so that it will be a more attractive and convenient place to live in. Every family should try to improve its surroundings. No house or garden is ever perfect, and improvements can usually be made that will add to the healthfulness, beauty, comfort, and convenience of the family's surroundings.

Anyone who decorates a home or plans furnishings for it must use mathematics over and over again. No one can lay out flower beds, shrubbery, driveways, or lawns without understanding how to use lines and angles. In any home you will see many examples of rectangles, triangles, circles, and other figures, because they are often used in design and decoration.

A person who understands the mathematics of design and decoration can plan more attractive and convenient arrangements than a person who knows nothing about such mathematics.

This chapter will tell you more about lines and figures and how they can be used to improve the home and its surroundings.

1. If you needed a new table for your dining room at home, what would you need to know about the room and about the table before you bought it?

2. Suppose you wanted to paper the walls of your room at home. What would you need to know about the room before you bought the paper?

3. Would you hang one small picture on a large wall? Why or why not?

4. Would you hang one large picture on a small wall? Why or why not?

5. Which would you use to make a small room look larger, plain wallpaper or figured wallpaper? Why?

6. What might be some of the defects in a house built without exact measuring being done?

7. When a modern home is built, everything is measured very exactly. Was this true when a frontier home was built? Why?

8. What has been done to make your home more attractive or convenient? How was mathematics used when this work was done?

9. What special things are done each summer and each winter to make your home more comfortable and more healthful? Give some examples of how mathematics may be used in doing this work.

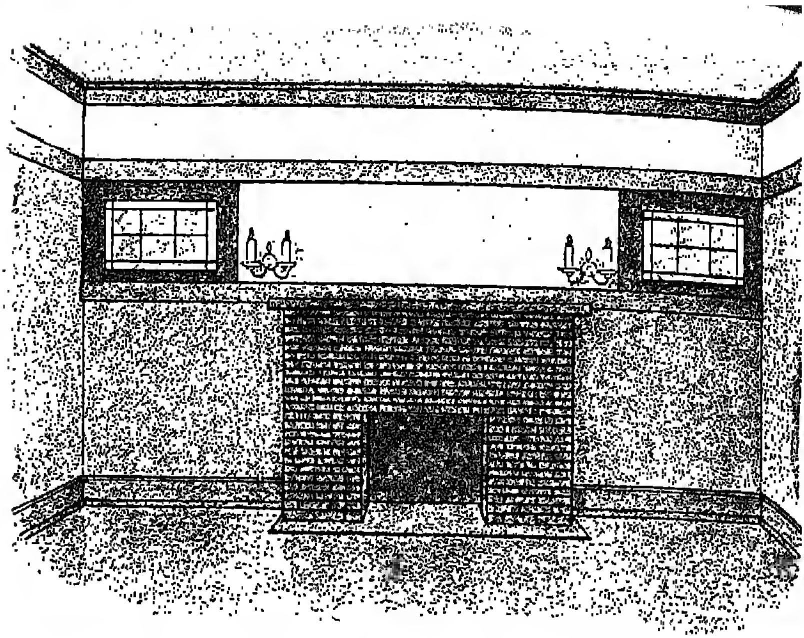
10. In what ways may a farm home be more beautiful, convenient, and healthful than a city home? In what ways may it be less so?

11. How can any boy or girl help to improve the family's surroundings? Have you helped to improve your family's surroundings in any way? If so, give some examples of any mathematics that you used.

12. When a home is improved, some of the work is often done by carpenters, plumbers, painters, architects, and other special workers. How is mathematics used by each of these workers?

13. Do the attractiveness, healthfulness, and comfort of your home depend at all upon what your neighbors do? If so, in what way?

14. What measuring machines or instruments are used in your home?



Lines and Design in Home Decoration

The picture above shows the Blairs' living room before it was remodeled. The picture on page 293 shows the room after it was remodeled. The pictures show how a different use of lines and design can change the appearance of a room. The Blairs' new living room looks larger than the old one, and the ceiling looks higher.

1. In the picture above, the dark wood trimming around the walls makes the ceiling look low because the eye naturally follows lines. What other things in the room make the ceiling look low?

2. How did removing the small windows change the appearance of this room?

3. What else did the Blairs do to the walls to make the ceiling look higher and the room larger?

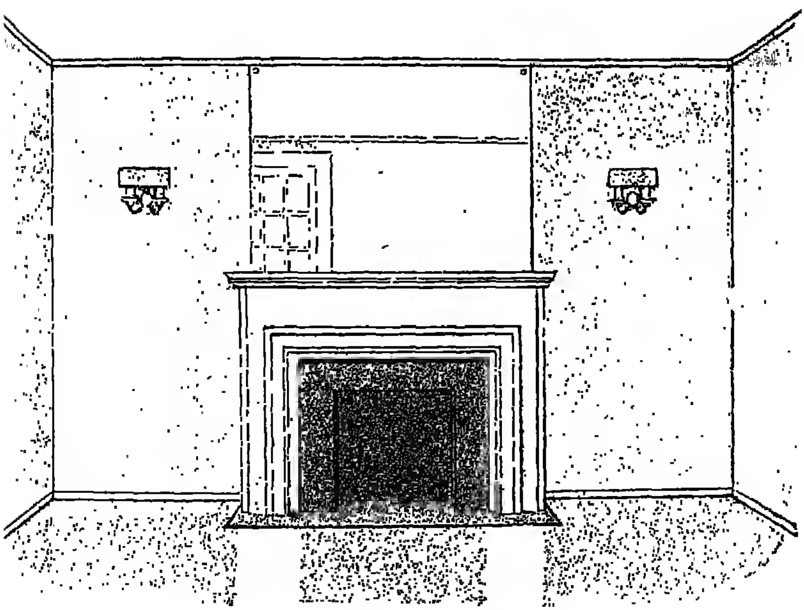
4. How did the mirror over the fireplace help the Blairs get the effect they wanted?

5. Did the light walls and the narrow white molding around the fireplace make the room look larger? Try to explain why.

6. There is one door in the living room. Which would be better for the Blairs to use, a plain door, a door with horizontal panels, or a door with vertical panels? Why?

7. To make the room look larger, which would be better for the Blairs to use, a rug that covered all the floor, or a rug that left some floor space showing all around it? Why?

8. Could Mrs. Blair make the room seem larger and higher by draperies and furniture arrangement? If so, explain how she might do this.



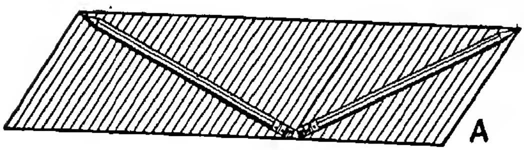
As you have just found out, the eye can be tricked. Lines and figures can be used to make objects appear longer, shorter, larger, or smaller than they really are. When a change of this kind takes place, it is called an "optical illusion."

9. There is an optical illusion in each of the six pictures below. Study each picture to find the illusion. You will probably need to use your ruler in some of the pictures to find how your eye is being tricked.

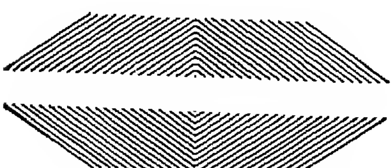
10. Which optical illusions shown below might be used in designing or in decorating? How might they be used?

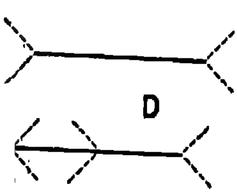
11. Do you know of any optical illusions that can be used in clothes to make a person look thinner or fatter, shorter or taller? If so, what illusions can be used in this way?

12. Find other optical illusions like those below.

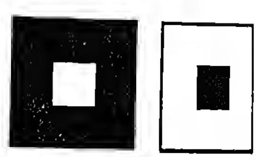

A

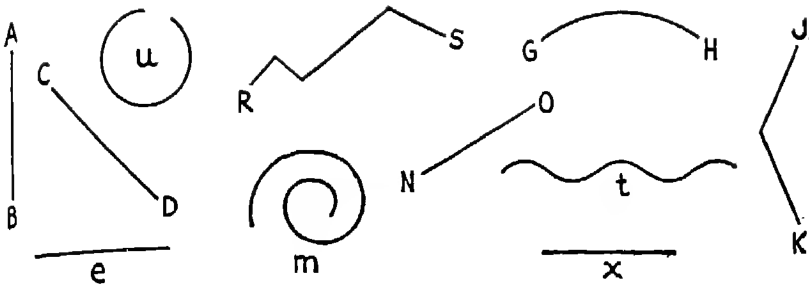

C


B


D


E


F



Learning about Lines

In planning and decorating their home the Blairs used all the knowledge they had about lines and figures. Such knowledge is even more important for engineers and architects. These men could not carry on their work without a thorough understanding of *geometry*, which includes the study of lines and figures. The three kinds of lines, straight, broken, and curved, are shown in the picture above.

1. A line is sometimes labeled by a capital letter at each end. The first line above is called line AB or line BA. The next line is labeled with the capital letters C and D. What is this line called?

2. The third line is labeled with a small letter. This line is called line e. Are line AB, line CD, and line e all straight lines?

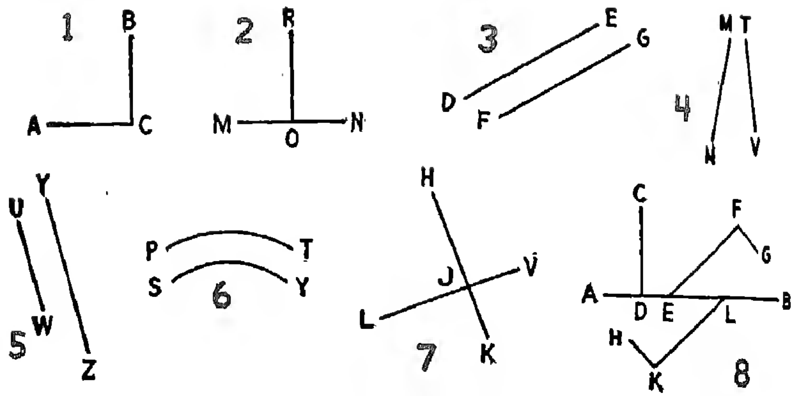
3. Name two other straight lines in the picture.

4. Line RS is a *broken line.* Why do you think it has been given this name?

5. Name another broken line in the picture.

6. Line GH is a *curved line.* Is line t also a curved line? Why?

7. Name two other curved lines in the picture.



8. In Figure 1 above, line *AC* meets line *BC* to make a square corner, or a __ angle.

9. Line *AC* is *perpendicular* to line *BC* because it forms a right angle with line *BC*. Is line *BC* perpendicular to line *AC*? Why?

10. Line *RO* in Figure 2 appears to be perpendicular to line __. Line *MN* appears to be perpendicular to what line?

11. In Figure 3 measure the distance between the lines in several places. When you do this, keep your ruler perpendicular to both lines. Is the distance always the same? Line *DE* and line *FG* are *parallel* because they will never meet, no matter how far you extend them.

12. Are the lines parallel in Figure 4? In Figure 5? In Figure 6? How do you know?

13. What lines in Figure 7 appear to be perpendicular? Why?

14. How many right angles do you see in Figure 8? What lines in this figure appear to be perpendicular? What lines are parallel?

Learning about Plane Figures

Home furnishings, floor coverings, and wall paper often have designs made up of *plane figures* like those shown below and on page 298. Plane figures are drawn on a flat surface, that is, on a *plane*. They are made of straight and curved lines.

When you examine each of the plane figures below and on page 298, ask yourself these six questions:

1. *How many sides does it have?*
2. *Are they straight or curved lines?*
3. *Are any of these sides parallel, and if so, which sides are parallel?*
4. *How do the sides compare in length?*
5. *How many angles does the figure have?*
6. *How many of them are right angles?*

1. Figure 1 below has __ sides. Are they straight or curved? The figure has __ right angles. Which sides are parallel? Which sides are equal in length?

2. In Figure 1, side AD is *opposite* side BC. Which side is opposite side AB?

3. Now tell four things about the sides of Figure 2. It has __ right angles. It is different from Figure 1 in just one way. In what way is it different?

4. In what one way is Figure 3 different from Figure 1?

5. In what one way is Figure 4 different from Figure 2?

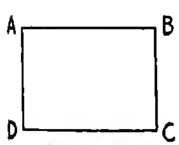


FIGURE 1

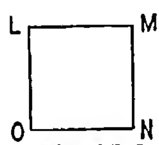


FIGURE 2

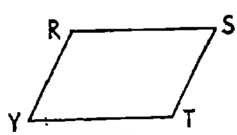


FIGURE 3

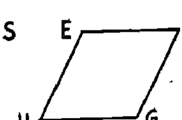
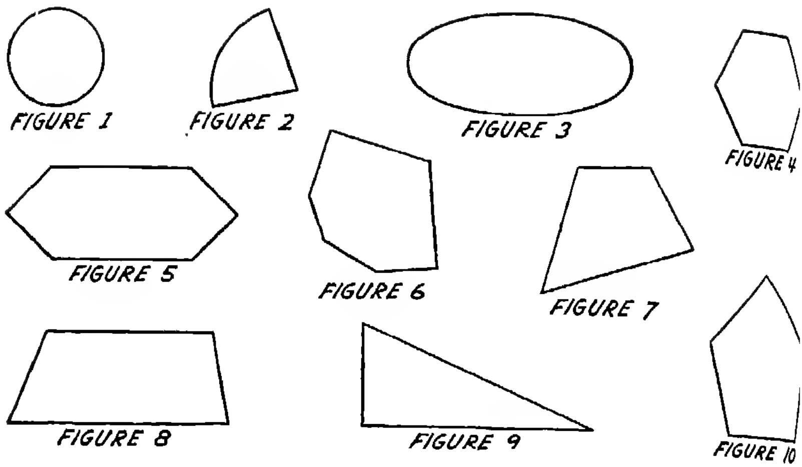


FIGURE 4



6. If the opposite sides of a four-sided figure are equal and also parallel, are all the angles right angles? Explain your answer.

7. Write on your paper the six questions near the top of page 297. Draw lines for ten columns opposite the questions. Label one column for each figure above. Then for each figure write the answer to each question. Use this work when you answer the questions below.

8. Figures 1, 2, and 3 are alike in only one way. In what way are they alike?

9. In what ways are Figures 1, 2, and 3 different from Figure 4?

10. Figure 4, Figure 5, and Figure 6 are alike in one important way. What is this important way?

11. In what way is Figure 5 different from Figure 4?

12. In what ways is Figure 6 different from Figure 4?

13. How are Figures 7 and 8 like the four figures on page 297? How are Figures 7 and 8 different from those four figures?

14. How is Figure 9 on page 298 different from all the other figures in the picture?

15. How is Figure 10 different from all the other figures?

16. Look at Figures 1 and 3 again. In what way is Figure 3 different from Figure 1?

17. Which of the figures might you use if you were making patterns or designs? Why?

18. Which figures might you not use if you were making patterns or designs? Why?

Think before You Answer

1. Does the size of a figure make any difference when you are deciding what kind of figure it is? Explain your answer.

2. Are the hands of a clock perpendicular to one another at 3 o'clock? At 12:15? At 9:00? At 11:45?

3. What is the largest number of angles that any 3-sided figure can have?

4. What is the largest number of right angles that a 3-sided figure can have?

5. Can you have a 4-sided figure that has no right angles in it? Can it have only 1 right angle? Can it have only 2 right angles? Only 3 right angles?

6. What is the largest number of angles that any 4-sided figure can have? What is the largest number of right angles that such a figure can have?

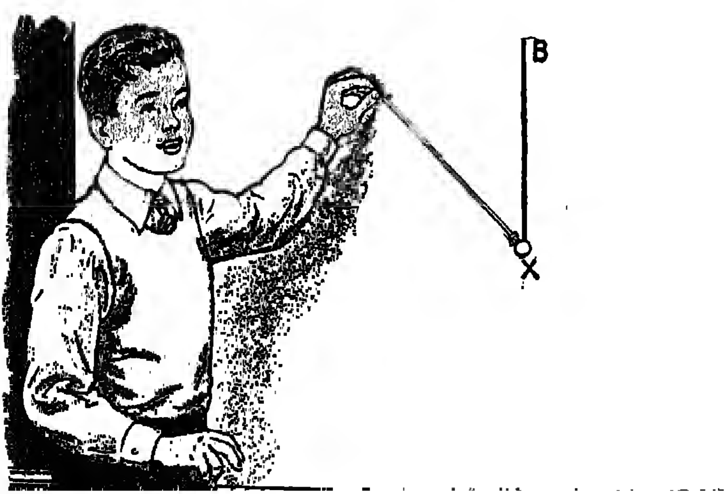
7. Is this statement correct? The number of angles in a figure is always equal to the number of its sides.

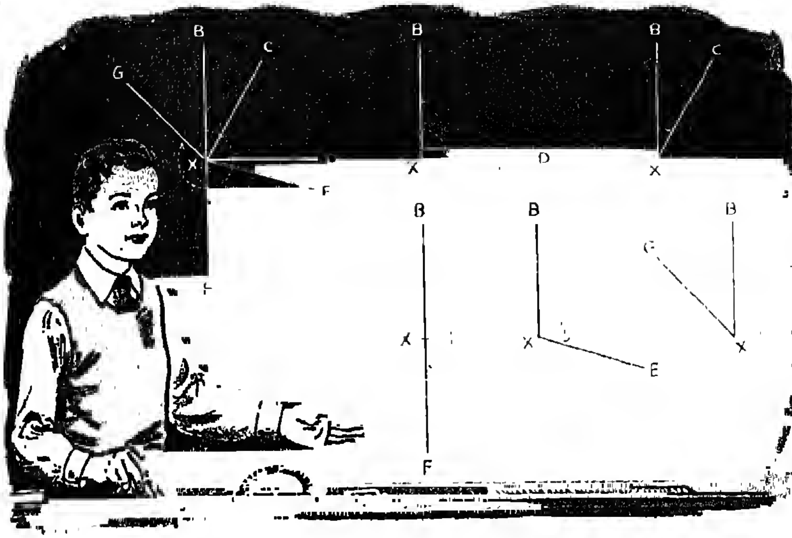
What an Angle Is

In the picture below, Don Blair is showing how angles are made. He fastened one end of a string at the point marked "X" on the cardboard. Then he stretched the string in the position shown by line XB. Keeping the string on the cardboard, Don is slowly swinging it around, or *rotating* it, to the right. When the string has come back to line XB, it will have made a *complete rotation.*

As the string rotates, it makes many angles with its original position. The picture on page 301 shows how Don marked some of the different positions the string reached. It also shows how he drew the angles that the string made with its original position when it reached these different positions.

1. Look at the picture on page 301. When the string reached the position XD, it had rotated one fourth of all the way around. It made a *right angle* with its original position BX. How do you know that this angle, which is read angle BXD or angle DXB, is a right angle?





2. Before the string reached the position XD, it passed through the position XC and formed angle BXC. Is this angle larger or smaller than a right angle? How do you know? Angle BXC is an *acute angle.*

3. When the string reached the position XF, it had made what part of a complete rotation? It made a *straight angle* with its original position. Why is "straight angle" a good name for angle BXF?

4. Before the string reached the position XF, it passed through the position XE and formed angle BXE. Is angle BXE larger or smaller than a right angle? Is it larger or smaller than a straight angle? Angle BXE is an *obtuse angle.*

5. When the string reached the position XG, it had made more than half of a complete rotation. How do you know? How do you know that the angle the string made with its original position was larger than a straight angle? This angle is a *reflex angle.*

6. The arrows in the angles on page 301 show the direction in which the line BX is rotating. We do not usually use arrows in acute, right, or obtuse angles. Why is it necessary to use arrows in straight angles and reflex angles?

7. How can you make an acute angle with your arm? How can you make a right angle? An obtuse angle? Can you make a straight angle? Why can you not make a reflex angle?

8. What kind of angle do the hands of a clock make at 6 o'clock? At 3 o'clock? At 1 o'clock? At 5 o'clock? At 11 o'clock? At 12:15? At 11:45?

9. Give some examples of acute, right, and obtuse angles in your schoolroom and home.

10. What angles can a door make with the wall?

11. In a column on your paper write the numbers that name the angles below. Then decide for each angle whether it is an acute, an obtuse, a straight, a right, or a reflex angle. Opposite the number for each angle write what kind of angle it is.

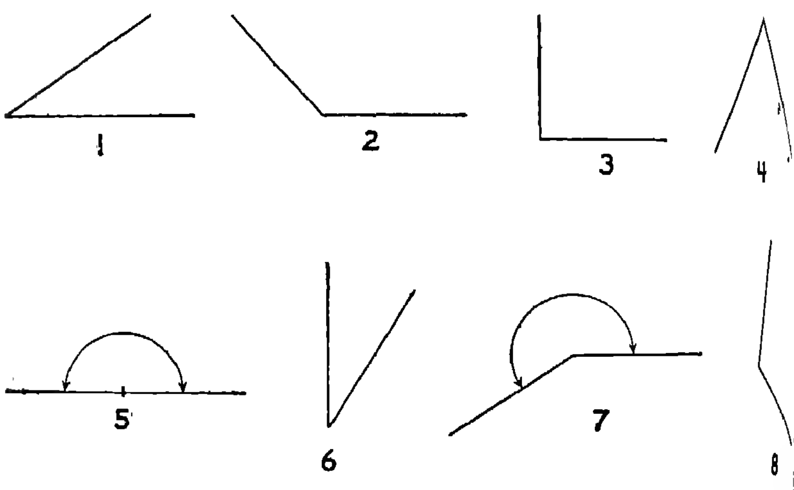


Figure 1 at the right shows an angle. You may say that an angle is an *amount of turning*, or *rotating*. You may also say that an angle is the figure formed by two straight lines drawn from a point.

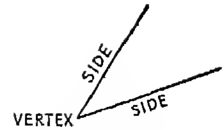


FIGURE 1

The point where the two lines meet is the *vertex* of the angle. The two lines are the *sides* of the angle.

12. Angle RTS is shown in Figure 2. Notice that when the letters that name an angle are read, the letter at the vertex is always the second letter to be read. The sides of angle RTS are line __ and line __. The vertex is the point __.

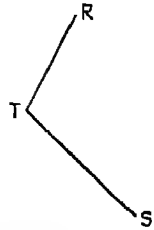


FIGURE 2

13. Figure 3 shows another way of labeling an angle. A small letter is placed *inside* the angle. This angle is called angle x. What kind of angle is angle x?

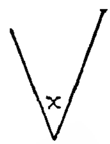


FIGURE 3

14. Remember always that the size of an angle does not depend on the length of its sides. In Figure 4, angle MNO, angle XYZ, and angle a are all the same size. The size of any angle depends *only* on the amount of rotation of a line. Each angle in Figure 4 is what kind of angle?

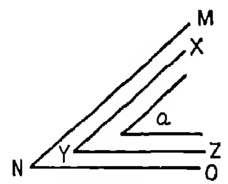


FIGURE 4

15. Copy the letters below in a column on your paper. They are the names of angles in Figure 5. Opposite each write the letters that name its two sides and its vertex. Also write the kind of angle each one is. AYT; AYF; AYR; BYF; BYA; RYT; FYR

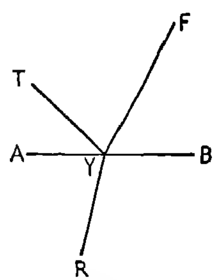


FIGURE 5

Measuring Angles

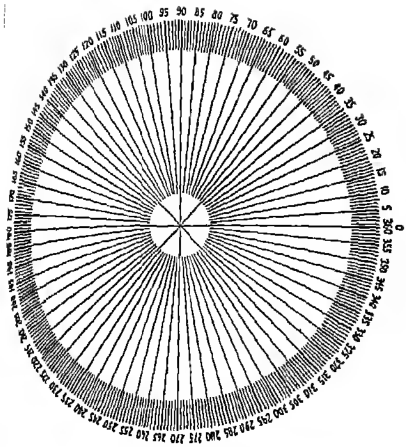
Mr. Blair wanted to saw a board to fit into a corner on the porch. So he used two narrow pieces of wood, fastened together as shown in the picture below, to make a model of the angle for sawing the board. He did this because he had no convenient way of measuring the angle.

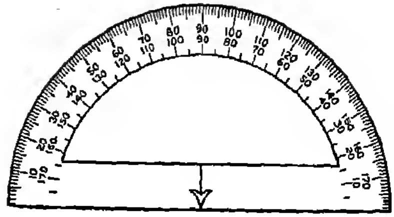
You know that distances are measured in inches, feet, yards, or miles, and that areas are measured in square inches, square feet, square yards, or square miles. Angles are measured in *degrees*.

The figure on the left on page 305 shows that a line turns through 360 degrees when it makes a complete rotation. The size of an angle is the number of degrees through which a line has turned.

1. If a line makes one fourth of a complete rotation, how do you know that it has rotated through 90 degrees? A 90-degree angle is a ___ angle.

2. How do you know that a straight angle is an angle of 180 degrees?





3. Is it correct to say that an angle of less than 90 degrees is an acute angle?

4. An obtuse angle is an angle that is more than _ degrees and less than _ degrees.

5. An angle that is more than 180 degrees but less than 360 degrees is a _ angle.

At the right is a short way to write 1 degree. The sign after the 1 means "degree" or "degrees." **1°**

For each angle whose size is given below tell whether it is an acute, obtuse, straight, right, or reflex angle.

6.	180°	30°	304°	120°	65°	90°
7.	18°	110°	185°	77°	194°	6°

An instrument used for measuring angles is shown at the right above. It is called a *protractor*. By comparing the picture of the protractor with the upper half of the circle beside it, you can see that the protractor shows one half of a complete rotation. The protractor shows 180 degrees. Examine the protractor and see how the degrees are marked on it.

The picture below shows how to measure angle BXC with a protractor. Notice that the protractor is placed so that side XC of the angle is lined up with the outside straight edge of the protractor. The arrow on the protractor is touching the vertex of the angle.

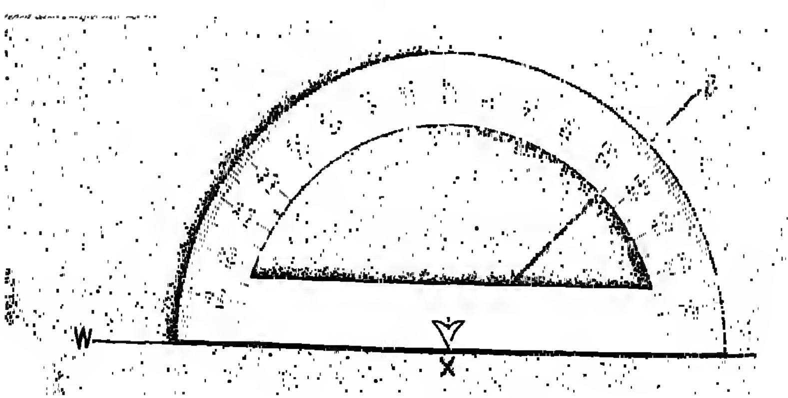
There are two rows of numbers on the curved edge of the protractor. These numbers help you read the degrees. The upper row is numbered from left to right, or in a *clockwise* direction. The lower row is numbered from right to left, or in a *counterclockwise* direction.

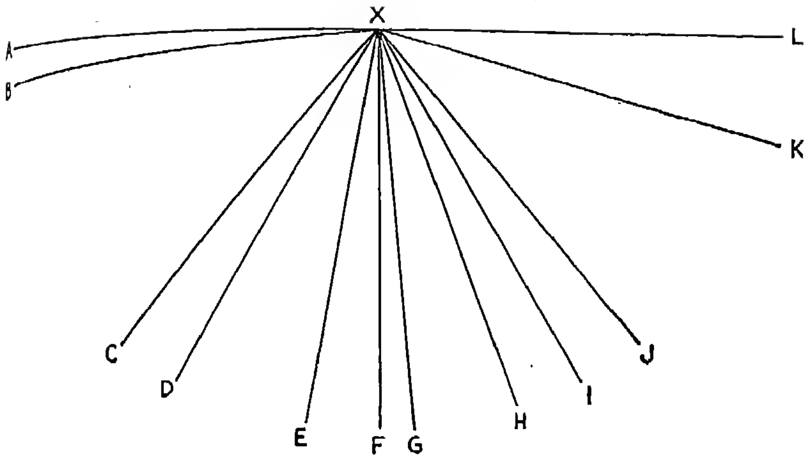
8. Now you can read the number of degrees in angle BXC. Side BX of the angle passes under the 45° mark on the protractor if you use the counterclockwise numbers. This side also passes under the 135° mark if you use the clockwise numbers. Why do you use the counterclockwise numbers in measuring angle BXC? There are __° in this angle.

9. You can measure angle WXB without moving the protractor. To do this, use the clockwise numbers. Why? How many degrees are there in angle WXB?

10. There are 180° in angle WXC. How do you know?

11. What kind of angle is angle WXB? Angle BXC?





12. You can find how many degrees there are in angle *WXB* on page 306 without measuring it. Since you know that angle *BXC* is an angle of 45°, you can find the size of angle *WXB* by subtracting 45° from 180°. Why do you subtract?

13. Use your own protractor to measure angle *BXC* and angle *WXB*. If you do not have a protractor, make one by tracing the protractor shown on page 306.

14. Each group of letters below names one of the angles in the diagram above. Copy these in a column on your paper. Measure each angle; then write the number of degrees opposite the name of the angle. Also write the word that tells what kind of angle it is.

AXC	*CXK*	*FXL*	*FXG*	*DXF*	*BXK*	*CXJ*
BXG	*JXH*	*KXA*	*EXL*	*KXF*	*DXH*	*LXD*

15. Can you tell, without measuring, the number of degrees in the angle that the hands of a clock make at 3 o'clock? Why would it be incorrect to say that the hands make a 90-degree angle at 12:15?

Drawing Angles

The pictures below show how Don drew a 55° angle with a ruler and protractor. He first drew line *BC* for one side of the angle. He wanted the vertex of the angle to be at *B*. So he placed the protractor along *BC* with the arrow at *B*. He then put a dot on the paper opposite the 55° mark on the protractor.

1. Why did he use the counterclockwise row of numbers when he found the 55° mark?

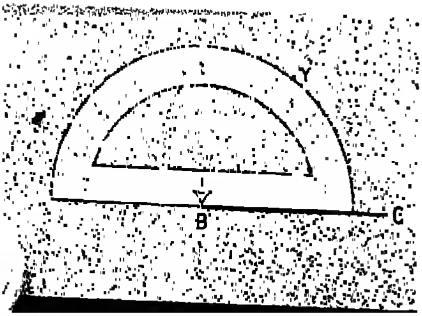
2. Don removed the protractor and drew a straight line through the dot to point *B* on line *BC*. Why did he draw the line to point *B*?

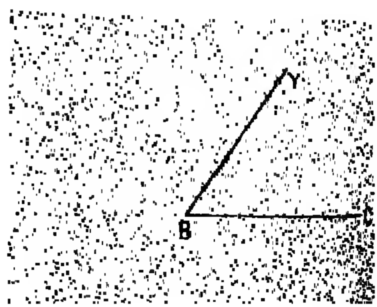
3. Did it matter whether Don drew a short line or a long line? Why? How did he label this line? Why did he label it?

4. If Don had wanted the vertex of the angle to be at *C*, how should he have placed the protractor? Which row of numbers should he have used to mark off a 45° angle? How do you know?

Draw the angles below with a ruler and protractor. Label each angle correctly.

5.	*ABC*, 75°	*LMN*, 20°	*DCO*, 95°	*XRT*, 40°
6.	*RVS*, 135°	*SVP*, 30°	*FGH*, 102°	*KLM*, 18°
7.	*OPR*, 90°	*DMV*, 63°	*LTS*, 15°	*QBR*, 162°





Four-Sided Figures

The quilt that Mrs. Blair is showing her friend in the picture below has a design with two kinds of four-sided plane figures in it. Figure 1 below shows one kind of these four-sided figures.

1. Figure 1 has __ straight sides.

2. Side AB is opposite side __. Side BC is opposite side __.

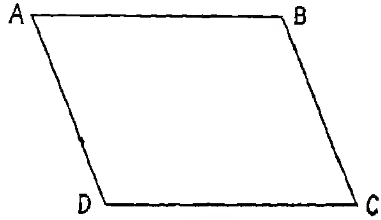


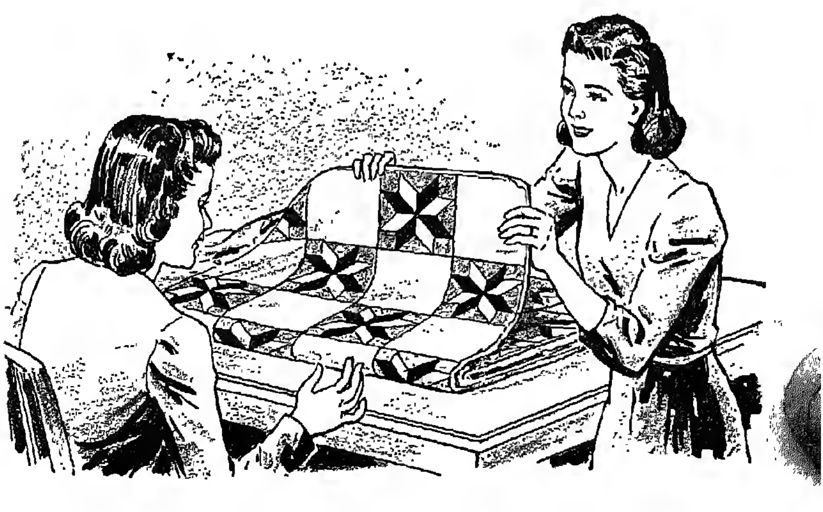
FIGURE 1

3. How do you know that side AB is parallel to side DC? Side AD is parallel to side __.

Any four-sided figure in which the opposite sides are parallel is called a *parallelogram.*

A parallelogram is a four-sided figure whose opposite sides are parallel.

4. Parallelogram $ABCD$ above has __ angles. Are any of them right angles? Are any of them acute angles? Are any of them obtuse angles?



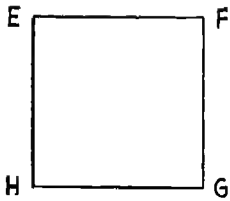


FIGURE 2

Figure 2 shows another kind of plane figure in the quilt design.

5. How many sides does this figure have? Are its opposite sides parallel? Is it a parallelogram?

6. Figure 2 is also a rectangle. How do you know? How do you know that the figure is also a square?

7. Which of the three names, parallelogram, rectangle, or square, gives you the most information about Figure 2? Why do you think so?

All squares and other rectangles are parallelograms because they have four straight sides and because their opposite sides are parallel.

8. How are the four angles in square *EFGH* above different from the four angles in parallelogram *ABCD* on page 309?

9. How are squares and other rectangles different from parallelograms that are not rectangles?

10. All rectangles are parallelograms. Are all parallelograms rectangles? Why?

11. Another plane figure sometimes used in design and decoration is shown in Figure 3 on page 311. How many straight sides does it have?

12. Which side is opposite side *LM?* How do you know that side *LM* and side *RN* are parallel?

13. Side __ is opposite side *LR*. Are side *LR* and side *MN* parallel? How do you know?

14. Is Figure 3 a parallelogram? How do you know?

Figure 3 is a *trapezoid.*

A trapezoid is a four-sided figure in which only one pair of opposite sides are parallel.

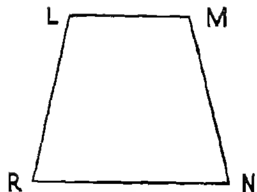


FIGURE 3

15. How is a trapezoid different from a parallelogram? In what other way is a trapezoid different from a rectangle?

16. Now look at Figure 4 below. How many sides does it have? Are any sides parallel? If so, which sides are parallel? Is Figure 4 a trapezoid? How do you know?

17. How many right angles does Figure 4 have?

18. Is it possible for a trapezoid to have only one right angle? Explain your answer.

19. Can any trapezoid have three right angles? Explain your answer.

20. Can a trapezoid have four right angles?

21. Write *rectangle*, *square*, *parallelogram*, and *trapezoid* on your paper. For each figure below decide what kind of four-sided plane figure it is. Write the number of the figure opposite the correct word on your paper. Some numbers can be written opposite two or three of the four words. Why?

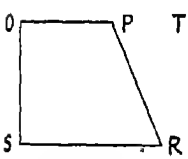


FIGURE 4

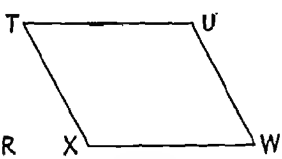


FIGURE 5

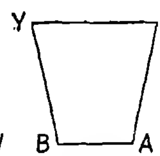


FIGURE 6

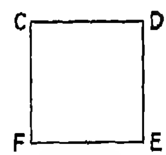


FIGURE 7

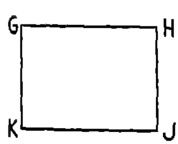


FIGURE 8

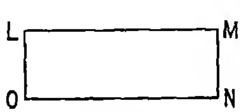


FIGURE 9

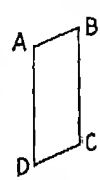


FIGURE 10

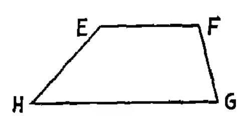


FIGURE 11

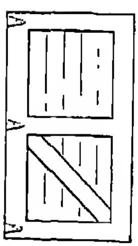
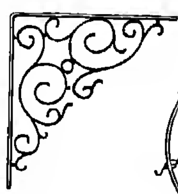
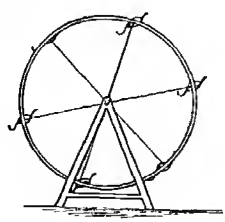
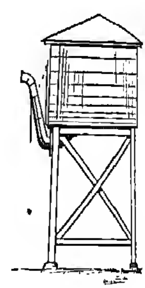
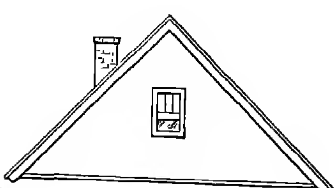
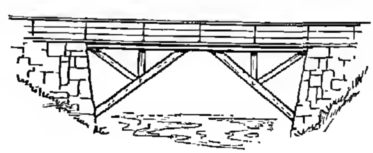
Kinds of Triangles

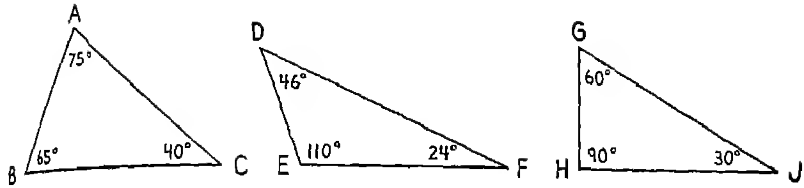
Jimmy Blair found that triangles are used in many common objects, some of which are shown below. He wondered why triangles are used so often.

To explain why, Mr. Blair first made a rectangle out of four pieces of light wood nailed with one nail at each corner. He showed Jimmy that by pushing on two opposite corners he could change the rectangle to a different kind of figure with four straight sides. What kind of figure resulted from his pushing the corners?

Then he made a triangle out of three pieces of wood nailed with one nail at each corner. Jimmy pushed hard on the triangle, but he could not change its shape or the size of its angles.

Because triangles are firm, or *rigid*, in this way, objects made in the shape of triangles are very strong. The brace on the door in the picture makes the door frame rigid because it is put on in such a way that triangles are formed. Most triangles have a pleasing appearance, too; so they are often used to decorate objects even where strength is not needed.



The first triangle shown above may be called triangle ABC, triangle BCA, or triangle CAB. The order in which you say the letters does not matter.

1. Every triangle has three straight sides and three angles. The three sides of triangle ABC are side AB, side BC, and side __. The three angles are angle ABC, angle BCA, and angle __.

The kind of triangle any 3-sided figure is, depends upon the size of its angles or upon how many equal sides it has. So when you examine a triangle, you should notice the size of its angles. Also notice whether or not any of its sides are equal.

2. Are there any right angles in triangle ABC? Are there any obtuse angles? Any acute angles? A triangle like triangle ABC, that has three acute angles, is called an *acute* triangle.

3. Now look at triangle DEF. Two of its angles are acute, and one is obtuse. Which angle is obtuse? A triangle like triangle DEF, that has one obtuse angle, is called an *obtuse* triangle.

4. How do you know that one angle in triangle GHJ is a right angle? Which angle is it? A triangle like triangle GHJ, that has one right angle, is called a *right* triangle.

When you say that a triangle is acute, right, or obtuse, you describe it *according to its angles*.

5. Measure side KL and side KM in triangle KLM at the bottom of this page. Are these two sides equal? Measure side LM. Is side LM equal to either side KL or side KM? A triangle like triangle KLM, that has two sides equal, is called an *isosceles* triangle.

6. Measure each side of triangle PQR. What do you discover about the three sides? A triangle like triangle PQR, that has all three sides equal, is called an *equilateral* triangle.

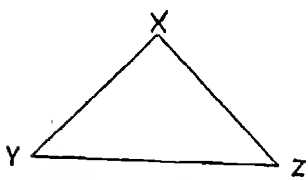
7. Now measure each side of triangle STV. Are any two of these sides equal? Triangle STV, which has no two sides equal, is called a *scalene* triangle.

When you say that a triangle is isosceles, equilateral, or scalene, you describe it *according to its sides.*

8. An isosceles triangle has __ sides equal.

9. An equilateral triangle has __ sides equal.

10. A scalene triangle has __ sides equal.

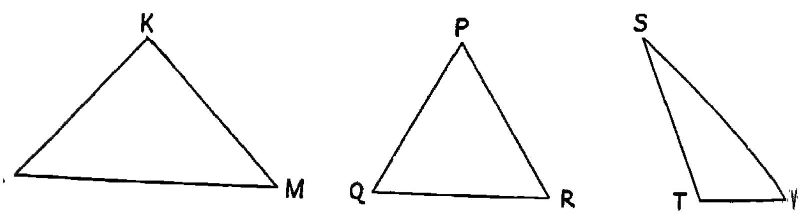


11. In triangle XYZ at the left, side __ and side __ are equal. Is triangle XYZ an isosceles, an equilateral, or a scalene triangle?

12. In triangle XYZ, side XZ is perpendicular to side XY. What does this tell you about angle ZXY? How do you know that triangle XYZ is a right triangle?

13. Can a right triangle also be an isosceles triangle?

14. Can a right triangle also be an equilateral triangle?



15. In triangle PQR on page 314 the sides are equal. Each angle equals 60°; so the angles are equal, too. Is it correct to say that an equilateral triangle has three equal angles? Is an equilateral triangle also an acute triangle? How do you know?

16. Which triangle on page 313 shows that a right triangle can also be a scalene triangle?

17. Can an equilateral triangle also be an obtuse triangle? Can a right triangle also be an obtuse triangle? How do you know?

Angles in a Triangle

Angles in a triangle are measured in the same way you measured the angles on pages 306 and 307.

1. Draw three large triangles, making them different in shape and size. Now measure each angle in each triangle with your protractor. Write the number of degrees on each angle in each triangle.

2. Find the sum of the angles in each triangle. If you have measured accurately, the sum of the angles in each triangle will be 180°.

FIGURE 1

FIGURE 2

3. There is another way to show that the sum of the angles in a triangle is 180°. Draw a large triangle and cut it out. Then tear off each corner, as shown in Figure 1 at the right. Arrange the corners as shown in Figure 2. How do you know that the sum of these angles equals a straight angle, or 180°?

4. The sum of the angles in any triangle is __°.

5. One angle of a triangle is 56°, and another angle is 18°. To find the third angle without measuring it, Helen added 56° and 18° and then subtracted their sum from 180°. Why could she find the size of the third angle in this way? The third angle is __°

6. Roy was asked if a triangle that had an angle of 60° and an angle of 30° was a right triangle. He said, "Yes." Was his answer correct? Why?

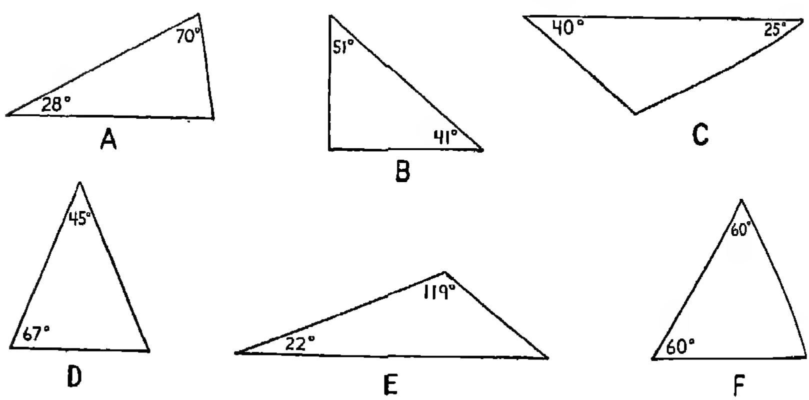
7. Can a triangle have angles of 70°, 14°, and 27°? Explain your answer.

8. Can a triangle have angles of 66°, 24°, and 93°? Why or why not?

9. Can a triangle have two right angles? Explain your answer.

10. How many obtuse angles can a triangle have?

11. Draw four columns on your paper. In the first column write the letters that name the triangles below. In the second column write the size of each angle for which the size is not given. In the third tell what kind each triangle is according to its angles, and in the fourth, tell what kind it is according to its sides.



Learning through Practice

1.

74			96			
43		\$4.72	82			849
36	.069	9.96	50		9.665	410
15	.257	5.36	29	\$532.80	2.743	936
46	.790	8.45	17	427.53	5.336	107
37	.907	1.69	47	192.36	.505	435

2.

$78\frac{1}{8}$	$586\frac{1}{2}$	$685\frac{1}{4}$	$665\frac{1}{12}$	$4\frac{1}{6}$	$79\frac{2}{3}$
$97\frac{2}{3}$	908	$986\frac{1}{4}$	$51\frac{1}{12}$	$64\frac{5}{8}$	$77\frac{1}{3}$
$37\frac{1}{2}$	$758\frac{3}{16}$	$845\frac{1}{3}$	$49\frac{1}{3}$	$36\frac{5}{6}$	$68\frac{5}{12}$

Divide to the nearest hundredth if necessary.

	A	B	C	D
3.	$.0021\overline{).2856}$	$106\overline{)559}$	$9.36\overline{).75}$	$.44\overline{)25.08}$
4.	$8.7\overline{).9483}$	$15\overline{)130}$	$3.29\overline{).63}$	$864\overline{)16421}$
5.	$228\overline{)1.3224}$	$6\overline{).759}$	$5.3\overline{).6572}$	$85\overline{)22100}$
6.	$187\overline{)64889}$	$9.8\overline{)343}$	$.065\overline{).254}$	$1.97\overline{)53.19}$

Find the answers for the following.

	A	B	C	D
7.	$7-\frac{5}{6}$	$\frac{2}{5}\div 1\frac{1}{2}$	$4\frac{3}{5}+7\frac{1}{6}$	$\frac{1}{4}\times 2\frac{2}{3}$
8.	$6\frac{5}{6}\div 5\frac{1}{4}$	$4\frac{4}{5}\times 3\frac{1}{6}$	$6\frac{1}{4}+8\frac{5}{6}$	$9\frac{7}{10}-9\frac{1}{5}$
9.	$2\frac{5}{12}+3\frac{3}{8}$	$1\frac{1}{12}-\frac{3}{8}$	$1\frac{1}{4}\div 3\frac{3}{4}$	$2\frac{1}{12}\times\frac{3}{10}$
10.	$5\frac{1}{2}-4\frac{9}{16}$	$3\frac{9}{10}\div 1\frac{5}{8}$	$1\frac{2}{3}+\frac{1}{2}$	$4\frac{9}{10}\times 5\frac{5}{6}$
11.	$\frac{1}{3}+8\frac{5}{12}$	$5\frac{1}{2}-3\frac{1}{2}$	$\frac{11}{12}\times 3\frac{3}{10}$	$4\frac{1}{5}\div 2\frac{1}{2}$

Problem Test 6

What must I find? Add? Multiply? Shall I subtract? Divide? W— What numbers shall I

1. A box of apples weighed 45 lb. 4 oz. The empty box weighed 3 lb. 11 oz. What did the apples alone weigh? (4)

2. Mrs. Carr bought $\frac{3}{8}$ yd. of cloth at \$1.60 a yard. She gave the clerk a five-dollar bill to pay for it. How much change should she have received? (4)

3. When Jim McNair traveled to his grandmother's home, he spent exactly 15 hours on the train. By timing all the stops, he found that the train stood still for $1\frac{5}{6}$ hours while he was on it. For how many hours was the train actually in motion while he was on it? (4)

4. The Acme Wholesale Grocery allows a discount of 5% for prompt payment. Find the saving that can be made by paying promptly a bill of \$76.80. (4)

5. Jean takes care of Mrs. Rose's baby in the afternoons for 24¢ an hour. Jean figures the time that she works very exactly. Last week she took care of the baby for $\frac{3}{4}$ hr. on Monday, $1\frac{1}{2}$ hr. on Tuesday, 2 hr. on Wednesday, and $1\frac{1}{3}$ hr. on Friday. How much should Mrs. Rose have paid Jean for this work? (5)

6. The Farmers' Elevator charges a $2\frac{1}{2}$% commission on sales. Find the commission due on a sale amounting to \$916. (5)

7. The interest for a year's loan of \$2700 was \$121.50. What rate of interest was charged? (6)

8. Mr. Burdick sold goods amounting to $400 in one week. He was offered a choice between two salary plans. Plan 1 was a salary of $40 a week, with an allowance of $10 for expenses. Plan 2 was a commission of 15% on all sales that week, with no allowance for expenses. Which plan was better for Mr. Burdick, and by how much was it better? *(6)*

9. Mr. Porter had a full barrel of maple syrup holding 39 gal. 3 qt. He drew off enough syrup to fill 4 cans, each holding 3 qt. 1 pt. How much syrup did he have left in the barrel? *(6)*

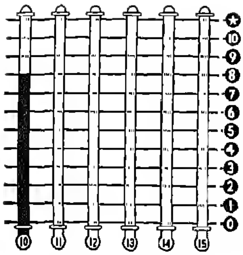
10. One summer Bill sold magazine subscriptions. He offered Mrs. Harmon a 1-year subscription for $1, or a 3-year subscription for $2. Mrs. Harmon decided to take a 3-year subscription. What rate of discount did she get by taking a three-year subscription instead of subscribing by the year for three years? *(6)*

11. Mrs. King stopped at the Traveler's Garage to have her automobile repaired. The mechanic started work at 11:50 and finished at 12:40. The labor cost of this repair was one dollar. This was a rate of how much an hour for labor? *(7)*

12. Helen and five friends made six smocks of different sizes and styles. The following amounts of cloth were used: $3\frac{1}{3}$ yd., 3 yd., $3\frac{3}{4}$ yd., $2\frac{1}{2}$ yd., $3\frac{2}{3}$ yd., and $2\frac{3}{4}$ yd. How much cloth was used in all? *(7)*

Standards for Problem Test 6

Poor	Fair	Average	Good	Excellent
0–6	7–14	15–31	32–45	46–64

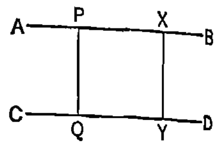


Self-Testing Drill 11

You will have exactly *20 minutes* for this drill. If you finish before the time is up, try "A Side-Trip in Mathematics" on pages 321 and 322.

Example 15 is wrong if any part is wrong.

1. Lines AB and CD at the right are parallel. If the perpendicular line PQ is four feet long, how long is the perpendicular line XY?



2. Divide 282,150 by 594.

3. 858,767 is __ less than 1,746,668.

4. Subtract:

$$\begin{array}{r} 112283.45 \\ \underline{12364.67} \end{array}$$

5.

$$\begin{array}{r} 6901 \\ 9688 \\ 800 \\ 8026 \\ 870 \\ \underline{5517} \end{array}$$

6.

$$\begin{array}{l} 3\frac{1}{4} \\ 6 \\ 2\frac{1}{3} \\ \underline{3\frac{3}{8}} \end{array}$$

7. What per cent of 7200 is 936?

8. 10 gal. 2 qt. $\div 3 =$

9. A discount of 25% is allowed on a bill of \$4466.00. Find the amount of the discount.

10. A 9% discount is given on a bill for \$87.50. Find the amount of the discount.

11. To the nearest whole dollar, find the answer for $\frac{4}{5}$ of \$642.

12. $4\frac{1}{8} \times 4\frac{2}{3} =$

13. $.69 \times 386.5 =$

14. Find the interest on \$350 at 3% for 1 yr. 6 mo.

15. Write on your paper the numbers that belong where the question marks are in the box below.

16. Multiply:

$$\begin{array}{r} 2379 \\ \underline{146} \end{array}$$

	FRACTION	DECIMAL	PER CENT
a	$\frac{3}{8}$	.375	?
b	$\frac{5}{8}$	?	$62\frac{1}{2}\%$
c	?	.875	$87\frac{1}{2}\%$

17.
4 gal. 2 qt.
3 qt.
3 gal. 1 qt.
3 qt.
1 gal. 1 qt.

18. $3.59\overline{)306586}$

19. 1240 is __% of 930.

20. For prompt payment a discount of $7.60 was allowed on a total bill of $950. What was the per cent of discount?

Standards for Self-Testing Drill 11

Number Correct	0	1–4	5–6	7	8	9	10	11	12	13–15	16–19	20
Rating	0	1	2	3	4	5	6	7	8	9	10	★

A Side-Trip in Mathematics

In all your mathematics work you can find your mistakes and can also save time and effort for yourself by checking your work.

It is very convenient to know simple and fast ways of checking. One interesting way is the method of casting out nines. You have already done this with addition and subtraction. The work on the next page shows how the method may be used with multiplication.

The work below shows how you can cast out nines to see if 134,480 is the correct answer for 205×656.

1. First cast out nines in 656. 6+5=11. Casting out 9, you have __ left over.

2. 2+6=8. You cannot cast out 9; so you have __ left over. Notice where the 8 is written.

```
   656 → 8
   205 → 7
  3280   56 → 2
13120
134480 ────→ 2
```

3. What is left over when you cast out nines in the multiplier? Where is this number written?

4. Now multiply the 8 by 7 and cast out nines in the answer. What is left over? Notice that the 2 is written with a circle around it.

5. Next add the figures in 134,480, casting out nines wherever you can. What is left over? This 2 is also written with a circle around it.

The two figures with circles around them are the same; so the work is probably correct.

Multiply in each example below. Then check your work by casting out nines. Correct any mistakes.

6. 539	**7.** 270	**8.** 568	**9.** 234	**10.** 748
482	35	380	86	329

Practice with Per Cents

1. 125% of 108 is __.

2. 220 is __% of 550.

3. \$1.45 is __% of \$58.

4. 12.3% of 700 is __.

5. 169 is __% of 520.

6. $62\frac{1}{2}$% of 12.8 is __.

7. __% of 48 is 8.

8. __% of 800 is 2.

9. 4.6% of 95 is __.

10. __% of \$4.50 is \$.09.

Building an Addition to a House

1. When the Lanes built an addition to their house, the building contractor estimated the cost as follows: foundation, $135; lumber and carpentry, $435; millwork, $80; plastering, $125; painting, $105; heating, $155; wiring, $60; plumbing, $265; sheet-metal work, $40. What was the total estimated cost?

2. The plans showed a bathroom on the first floor of the addition. By changing this bathroom to a lavatory, the contractor was able to deduct $125 from the total estimate. Find the total estimate then.

Deduct means take away from, or subtract.

3. The contractor agreed to use some second-hand lumber and reduced the estimate for lumber and carpentry by 10%. What was the total estimate after this second change?

DIAGRAM 1

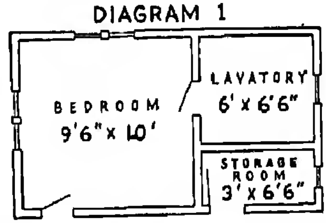
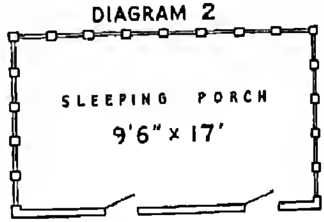


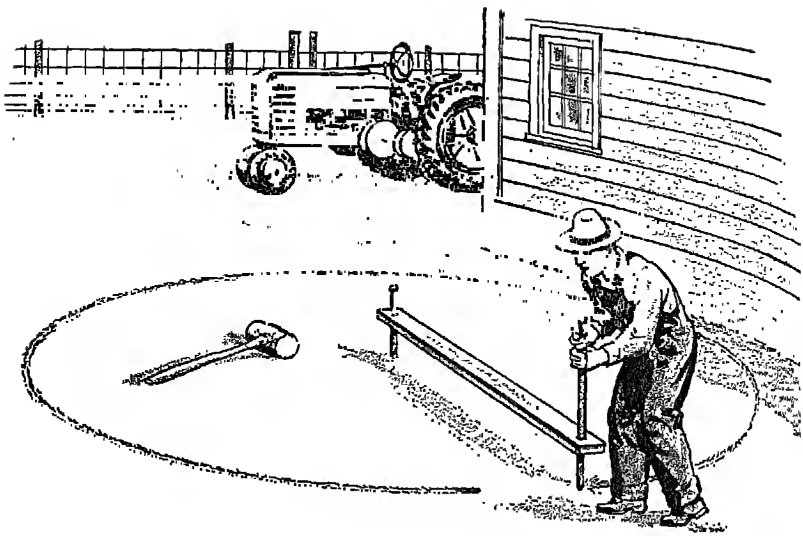
DIAGRAM 2



4. Diagram 1 is the first-floor plan of the addition. The lavatory was to have a tile floor and the other two rooms were to have wooden floors. How many square feet were to be covered with tile? With wood?

5. Diagram 2 is the second-floor plan. ___ sq. ft. of cork flooring were needed for this sleeping porch.

6. The total bill was $1247, but Mr. Lane was given a 2% discount. Was the net cost more or less than the final estimate? How much more or less was it?



The Circle

The picture above shows how Mr. Wagner marked the place where he planned to put the foundation of his new silo. He used a rod to fasten one end of a board to the ground. He drove a second rod through the other end of the board. Then, when he pushed the board with this rod, it marked a line on the ground. He pushed the board so that it made a complete rotation.

When you look at the curved line that Mr. Wagner drew, you probably feel quite sure that it is a *circle.* But of all the different kinds of curved lines, only one kind is a circle. You need to know certain things about circles before you can be sure that the line Mr. Wagner drew is a circle.

1. When he was through, there was no way to tell where the line began or where it ended. It was a *closed curved line.* Why is this a good name for such a line?

A circle is always a closed curved line.

2. The rods were 8 ft. apart. So no matter where you might measure the distance from the closed curved line to the place where the board was fastened to the ground, it would always be __ ft.

3. Within every circle is a point, called the *center*, which is the same distance from any point on the closed curved line. Is it correct to say that the place where the board was fastened to the ground was the center of the circle Mr. Wagner drew? Why?

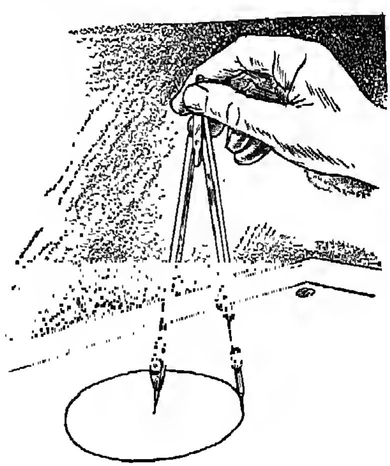
A circle is a closed curved line drawn in such a way that the distance from the curved line to the center is the same, no matter where you measure it.

4. The distance from the center of a circle to any point on the closed curved line is called the *radius* of the circle. Mr. Wagner used a radius of __ ft.

5. If he had used a 10′ radius, would the circle have been larger or smaller? If he had used a 6′ radius, would the circle have been larger or smaller?

A circle's size depends on the length of its radius.

6. The picture below shows how a circle was drawn with compasses. The sharp point of the compasses was pushed into the paper. Then the point with the pencil was completely rotated. Which of the two points was the center of the circle?



7. The points of the compasses were 2″ apart. The radius of the circle was __″.

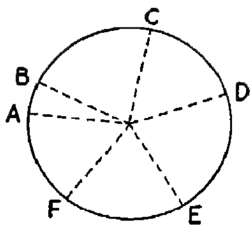


FIGURE 1

8. Look at Figure 1. Is each dotted line a radius of the circle? How do you know?

9. When you mean more than one radius, say "radii." How many radii are shown in Figure 1? Are they all drawn from the center of the circle? Are all these radii the same length?

10. Is it correct to say that a circle can have any number of radii? Explain your answer.

11. In Figure 2 below, how many radii are shown in the circle? Do these radii form a straight line? The straight dotted line touches the circle in how many places? Does it pass through the center of the circle?

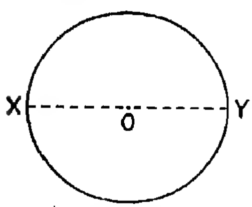


FIGURE 2

If a straight line passes through the center of a circle and touches two points on the circle, it is a *diameter* of the circle.

12. Can a circle have more than one diameter? How many can it have? Are all diameters of the same circle the same length? How do you know?

13. Is it correct to say that a circle's diameter is twice as long as its radius? How do you know?

14. Is it correct to say that the size of a circle depends on the length of its diameter? Explain your answer.

15. A straight line touches a circle in two places but does not pass through the center. Is the line a diameter of the circle? Explain your answer.

16. A straight line from the center of a circle to any point on the circle is called its __.

17. A straight line passing through the center of a circle and joining two points on the circle is called a __ of the circle.

The length of the closed curved line that Mr. Wagner drew is a little over 50 ft. This length is the *circumference* of the circle he drew.

18. The length of a circle is the __ of the circle.

19. For each figure at the bottom of the page tell whether or not the figure is a circle and give a reason for your answer. If the figure is a circle, name all radii and all diameters shown.

20. Use compasses to draw circles with the radii given below.

$1''$ $\quad 1\frac{3}{8}''$ $\quad 2''$ $\quad \frac{1}{2}''$ $\quad 2\frac{1}{4}''$ $\quad 1\frac{7}{8}''$ $\quad 2\frac{5}{8}''$ $\quad 1\frac{1}{4}''$

21. Can you draw a circle with a circumference of 42 in.? Explain your answer.

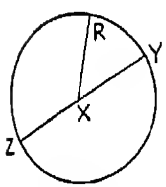


FIGURE 1

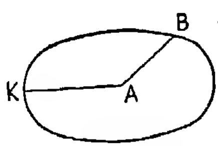


FIGURE 2

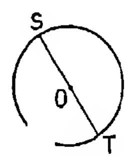


FIGURE 3

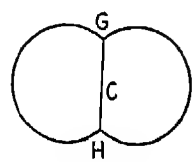


FIGURE 4

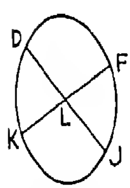


FIGURE 5

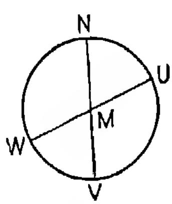


FIGURE 6

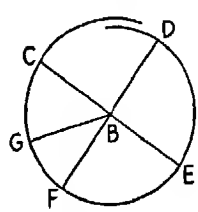


FIGURE 7

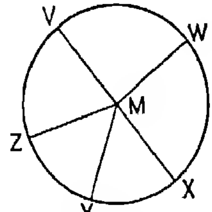
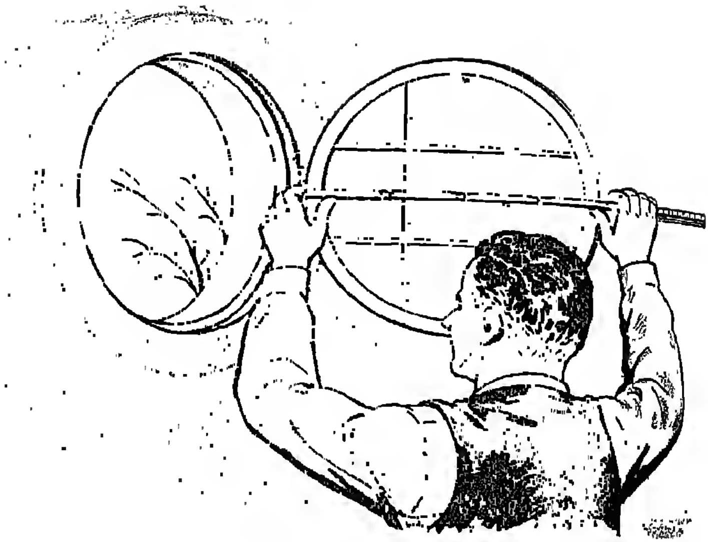


FIGURE 8



Measuring Circles

The picture shows Mr. Blair measuring the diameter of a circular window in the hall of his home so that he will know how much weather stripping he will need to go around it. When he did this, Don asked, "Why do you measure the diameter? I should think you would have to measure the circumference."

Mr. Blair said, "Well, it's easier to measure the diameter than it is to measure the circumference. Besides, I know that the circumference of any circle is about $3\frac{1}{7}$ times its diameter. The diameter of this window is 24 inches. So the circumference of the window is $3\frac{1}{7}$ times 24 inches."

1. Don multiplied 24 by $3\frac{1}{7}$ and got $75\frac{3}{7}$ for his answer. Did he multiply correctly?

2. How did Mr. Blair know where to measure the diameter of the window?

3. Don measured the circumference of the window to see if what his father had said was correct. He found that the circumference was about $75\frac{1}{2}$ in. Was this approximately the same as the circumference he found by multiplying 24 inches by $3\frac{1}{7}$?

4. Then Don divided this circumference by the diameter. When he divided $75\frac{1}{2}$ by 24, his answer was $3\frac{7}{48}$. Was this approximately $3\frac{1}{7}$, the figure his father used?

5. Did it matter whether Mr. Blair used $75\frac{1}{2}$ in. or $75\frac{3}{7}$ in. as the circumference of the window in deciding how much weather stripping to buy? Why?

The circumference of any circle is about $3\frac{1}{7}$, or 3.14, times as long as its diameter. In more exact work the circumference is figured as 3.1416 times the diameter.

None of the three numbers is exactly correct. In fact, it is impossible to find the exact number. For your work with circles, 3.14 will be exact enough.

Mathematicians use a letter from the Greek alphabet to represent $3\frac{1}{7}$, or 3.14, or 3.1416. This letter is shown at the right. When you read it, say, "pie." The name of this letter is spelled *pi*.

$$\pi$$

The formula at the right is used for finding the circumference of a circle when you know the length of its diameter. This formula means that the circumference is equal to *pi times the diameter*.

$$c = \pi d$$

You may use $3\frac{1}{7}$, 3.14, or 3.1416 in place of π in this formula. Since 3.14 is accurate enough for your work now, think of the formula for finding the circumference as $c = 3.14d$.

6. Study Example A to learn how to use the formula to find the circumference of the Blairs' circular window.

You use 3.14 in place of π and 24 inches in place of d when you rewrite the formula.

You multiply 24 inches by 3.14 because πd means $\pi \times d$.

The circumference of the circle, figured in this way, is — inches.

A

$c = \pi d$

$c = 3.14 \times 24$ in.

$c = 75.36$ in.

7. In the work you have done so far, three different circumferences have been found for the window. Don's measurement was $75\frac{1}{2}$ in.; figured from his father's measurement, the circumference was $75\frac{3}{7}$ in.; and you just figured it as 75.36 in. by using the formula. Why are these circumferences not the same? Does it matter?

8. Don tried out the formula by finding the circumference of a cold-air register. When he measured its diameter, he found that it was 4 ft. Study the work in Example B to see how he found the circumference.

He used — in place of π. What did he use in place of d?

What did he find for the circumference?

B

$c = \pi d$

$c = 3.14 \times 4$ ft.

$c = 12.56$ ft.

9. His father helped him to put a long string once around the register. The part of the string he used measured about 13 ft. Which was closer to the real circumference, 12.56 ft. or 13 ft.? Why do you think so? Was either of these exactly correct? Explain your answer.

10. If Don had measured the radius instead of the diameter, what would he have had to do before he could have used the formula $c = \pi d$ to find the circumference?

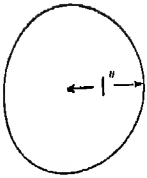


FIGURE 1

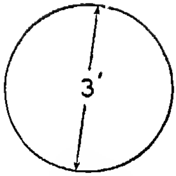


FIGURE 2

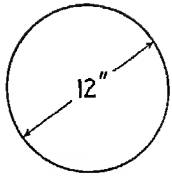


FIGURE 3

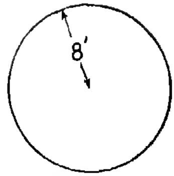


FIGURE 4

11. Find the circumference of each circle shown above. Then compare your work with the work in Self-Help Examples C to F below. Correct any mistakes you make. In Figure 1, before you can use the formula $c=\pi d$ to find the circumference, you must multiply 1" by 2. Why?

C	D	E	F
$c = \pi d$	$c = \pi d$	$c = \pi d$	$c = \pi d$
$c = 3.14 \times 2''$	$c = 3.14 \times 3$ ft.	$c = 3.14 \times 12$ in.	$c = 3.14 \times 16$ ft.
$c = 6.28''$	$c = 9.42$ ft.	$c = 37.68$ in.	$c = 50.24$ ft.

12. Find the circumference of each circle below. One way to find the circumference of Figure 5 is to multiply .25 mi. by 3.14. Why can you use .25 mi.? Why can you use 2.25 to find the circumference of Figure 7?

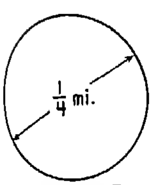


FIGURE 5

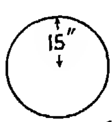


FIGURE 6

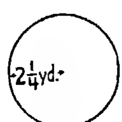


FIGURE 7

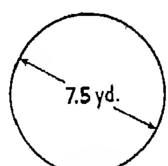


FIGURE 8

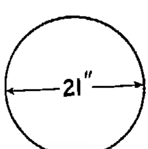


FIGURE 9

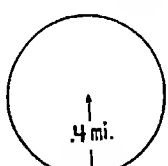


FIGURE 10

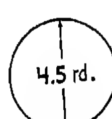


FIGURE 11

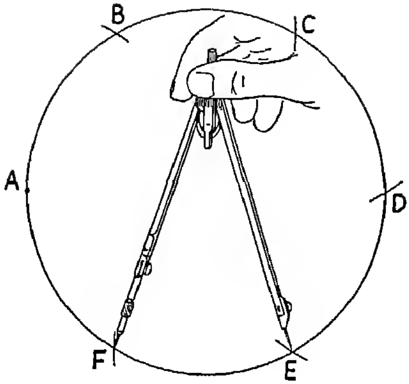


FIGURE 1

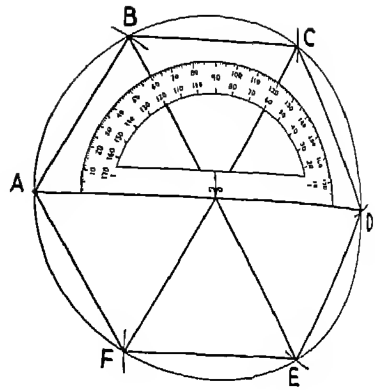


FIGURE 2

Circles in Design

When Jim drew a design using a figure with six equal sides, he first drew a circle. Then, without changing the distances between the points of his compasses, he marked off the short curved lines, or *arcs*, shown in Figure 1 above.

1. Jim used point A as the center when he drew the arc at B. He used point B as the center when he drew the arc at C. Explain how he drew each of the other arcs. Why did he not make an arc at point A?

2. Next he connected the points at which the arcs crossed the circle. You can see the six-sided figure in Figure 2. How do you know that all of its sides are equal in length? How many diameters has he drawn?

A six-sided figure like the one Jim drew, in which all the sides are equal, is called a *regular hexagon.*

3. Figure 2 also shows how Jim measured one of the angles at the center of the hexagon. Is this angle also at the center of the circle? This angle measures __°.

4. In Figure 2, radii are drawn from the corners of the hexagon. These radii make 6 angles at the center of the hexagon, which is also the center of the circle. If you measured these angles, you would find they are equal. So all six angles measure $6 \times 60°$, or __°.

There are 360° in a circle.

5. Figures 3 and 4 below and Figures 5 and 6 on the next page show how Jim drew a square by using what he knew about circles and angles. First he drew a circle. Since he was going to draw a four-sided figure, he thought: "If I draw radii from the corners of the square, each angle at the center will be $360° \div 4$, or __°."

6. Why did he use 360°? Notice how he marked 90° on the circle in Figure 3.

7. In Figure 4 you can see how Jim set the points of his compasses for the distance from G to H. How did he know that this distance would be equal to one side of the square that he was drawing?

8. In Figure 5 on page 334 Jim has marked off two arcs on the circle. Explain how he did this.

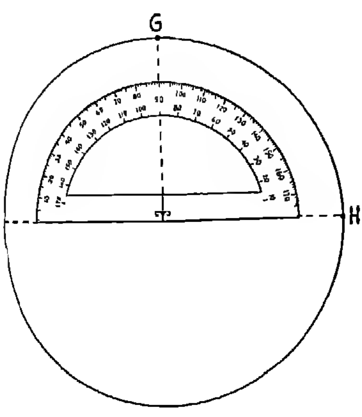


FIGURE 3

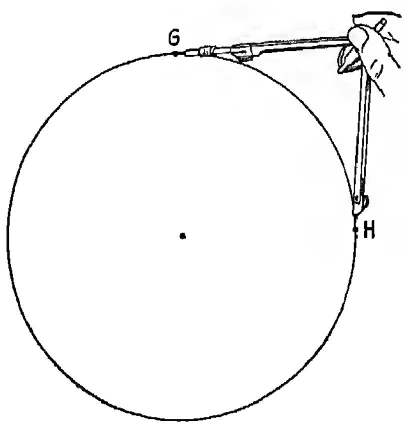


FIGURE 4

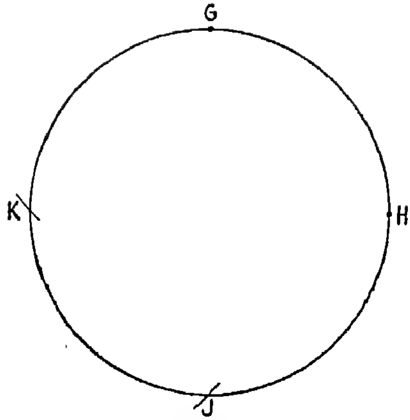


FIGURE 5

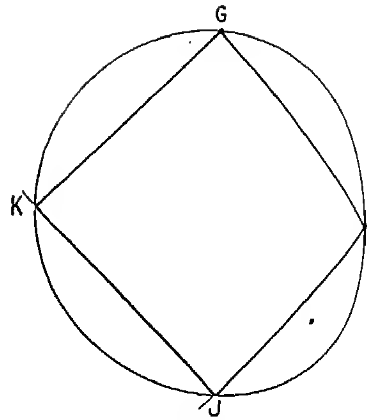


FIGURE 6

9. The completed figure is shown in Figure 6. How can you prove that this figure is a square?

10. You can use Jim's method to draw other figures. To draw a figure with five equal sides, first draw a circle. Then think: "$360° \div 5 = 72°$." How will you mark a 72° angle inside the circle? What do you do next? How do you complete the figure?

11. Use your compasses, protractor, and ruler to draw figures with the following number of equal sides: 4 sides, 6 sides, 5 sides, 8 sides, 3 sides.

12. To draw a six-pointed star, first mark off on a circle six points that are the same distance apart. Then join each point to two other points. Try it.

13. To draw a five-pointed star, first mark off on a circle five points that are the same distance apart. Then join each point to two other points.

14. Use your compasses, protractor, and ruler to make a design of your own. Make it as large as possible. You may color your design if you wish.

Without Pencil

	A	B	C	D	E	F
1.	Add: $16\frac{2}{3}$ 17	$14\frac{3}{4}\%$ = what decimal ?	$54\overline{)325}$	Multiply: 7 lb. 12 oz. 4	8 × 73	44 is __ % of 55.
2.	Subtract: 19.06 8.40	40 % of 300 =	Which is more, .001 or .0002 ?	Subtract: 657 $7\frac{5}{8}$	Multiply: 120 $2\frac{1}{2}$	$1\frac{4}{5}$ = _____ %
3.	$2\frac{1}{12} \times \frac{3}{10}$	Interest on \$50 for 1 year at 6 % is \$___	3 ÷ 5	$\frac{12000}{15000}$ in simplest form is _______.	.009 = ___.__ %	$.4\overline{).008}$
4.	1200 is ___ % of 400.	51 60 271 28	Subtract: 830 187	$\frac{1}{3} \div 1\frac{3}{8}$	$\frac{3}{8} \times \frac{1}{10}$	$66\frac{2}{3}\%$ of \$96 = ...

Think before You Answer

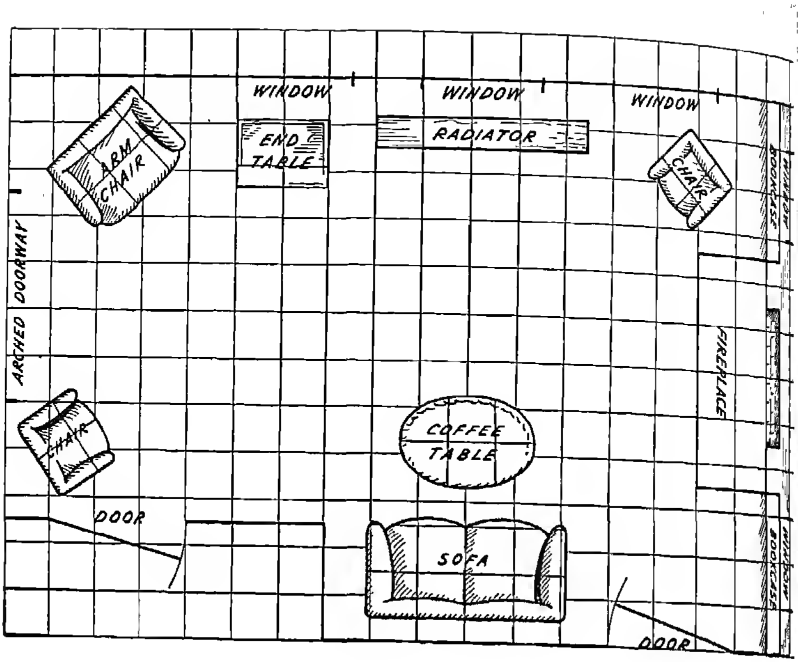
1. When a phonograph record goes around and around, is the path that the needle follows a curved line? Is the path a circle? Explain your answers.

2. Can an angle whose sides are each 2 ft. long be smaller than an angle whose sides are each only 1 ft. long? Explain your answer.

3. Explain how you can use a protractor to draw an angle of 270°.

4. The longest straight line that can be drawn inside a circle is a __ of the circle.

5. A line that divides a circle into two equal parts is a __ of the circle.



Scale Drawing

The Warrens recently remodeled their living room. Mrs. Warren wondered what would be the best way to arrange their furniture in the new room, but she did not want to drag it back and forth over the newly varnished floor. So first she made this plan of the room *to scale.* This means that on the plan she showed the shape of the room but she did not show its actual size.

A *scale drawing* of an object may be larger than or smaller than the object, but it always shows the *shape* of the object.

1. Mrs. Warren decided to make her scale drawing $4\frac{1}{2}$ in. long. Since the room was 18 ft. long, she used the scale $\frac{1}{4}'' = 1'$. What figuring might she have done to get this scale?

2. The room was 12 ft. wide at its widest part. How did Mrs. Warren know that the widest part of her scale drawing should measure 3 in.?

3. She made the scale drawing on squared paper. The lines on this paper are $\frac{1}{4}$ in. apart. The distance between any two lines on this paper represents __ ft.

4. The fireplace in the living room was actually 5 ft. long. How did Mrs. Warren know that on the scale drawing she should make the fireplace $1\frac{1}{4}$ in. long?

5. Was it correct to make the fireplace on the scale drawing 5 squares long? How do you know?

6. There was a window above each of the two bookcases. Each of these windows was 2 ft. wide. Are these windows marked correctly on the scale drawing? How do you know?

7. Each of the other three windows in the room was 30 in. wide. They were 18 in. apart. On the scale drawing each window should be __ in. wide. The windows should be __ in. apart in the drawing. Are they marked correctly on the scale drawing?

8. The arched doorway is __ squares wide on the scale drawing. How wide was this doorway in the actual living room?

9. Each of the other two doors in the room was actually __ ft. wide.

10. Do both of these doors open the same way? How do you know?

11. The radiator was actually __ ft. long.

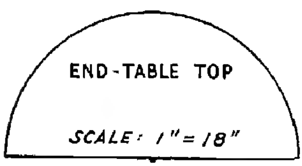
12. Mrs. Warren also made scale drawings of the furniture, using the scale $\frac{1}{4}'' = 1'$. She cut out these drawings and then placed them in different positions on the drawing of the living room until she found the positions where the furniture seemed to fit best. Why did she use the same scale she used for the room?

13. How could Mrs. Warren tell how much space there was in the room between the pieces of furniture?

14. Are there any inconvenient places in her arrangement of the furniture? If so, where are they? What changes would make them more convenient?

15. If Mrs. Warren had used the scale $\frac{1}{2}'' = 1'$ for her drawings of the furniture and kept the scale of $\frac{1}{4}'' = 1'$ for the drawing of the room, could she have told how the pieces fitted in the room? Why?

16. Make a scale drawing of the Warrens' living room, using $\frac{1}{2}'' = 1'$ as the scale. Then measure the furniture in your living room at home and make scale drawings of it. Make a good arrangement of this furniture on your drawing of the Warrens' living room.



17. Sam Warren used the scale drawing shown at the left when he made an end table for his mother. What scale did he use? What does this scale mean?

18. Is it correct to say that the long straight line in the scale drawing above is a diameter? Why?

19. This line is $1\frac{1}{2}$ in. long. How long should Sam have made this side of the table?

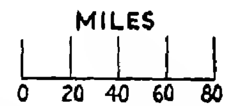
20. If the scale had been $1'' = 9''$, how long should he have made this side of the table?

Practice in Scale Drawing

1. A rectangular lawn is 60 ft. long and 45 ft. wide. Make a diagram of this lawn, using the scale $1'' = 15'$

2. Make a scale drawing of a room in your house, using the scale $1'' = 8'$.

3. On a floor plan drawn to the scale $1'' = 16'$, how long a line represents 32 ft.? 12 ft.? 24 ft.?



4. Maps, diagrams, and pictures are all scale drawings. Sometimes the scale used is shown, and sometimes it is not. On many maps the scale appears in the way shown above at the right. In this scale the line is 1 in. long and is divided into fourths of an inch. This means that a distance of 1 in. on the map represents an actual distance of 80 mi. Would it be correct to write the scale shown above as 1 in. = 80 mi.?

5. On a map drawn to the scale shown above, two cities are $1\frac{3}{4}$ in. apart. The two cities are actually how many miles apart?

6. Sometimes a scale is written as a fraction. The scale "$\times\frac{1}{2}$" means that the dimensions of the picture are $\frac{1}{2}$ as long as those of the object drawn. For example, the picture of a bird is $3\frac{1}{2}$ in. long and is marked "$\times\frac{1}{2}$." How long is the real bird?

7. Does the scale "$\times 3$" mean that a picture is larger or smaller than the object? How do you know?

8. In a baseball diamond the pitcher's box is $60'$ from the home plate. On a diagram that is drawn to the scale $1'' = 15'$, how far should the pitcher's box be from the home plate?

Short Cuts in Problem Solving

1. Look at Picture 1 below. Does the problem have two steps? Find the answer for this problem.

2. Now look at Picture 2. How did Bill show the work for the first step? How did he show that the second step is to divide by 50?

3. When Bill canceled, he first divided 10 into the 40 above the line. What number below the line did he also divide by 10? When he canceled again, he divided __ and __ by 5. How did he get 20?

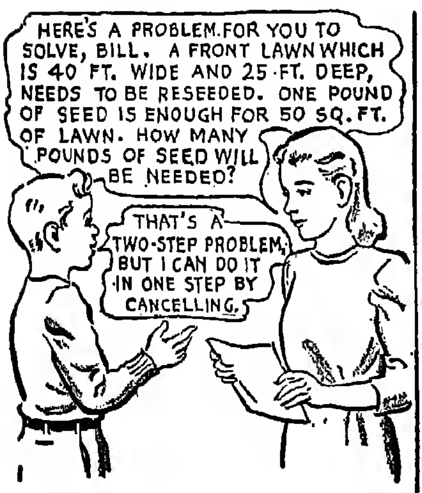
When 2-step problems can be solved by multiplication and division, cancellation will sometimes make your work easier.

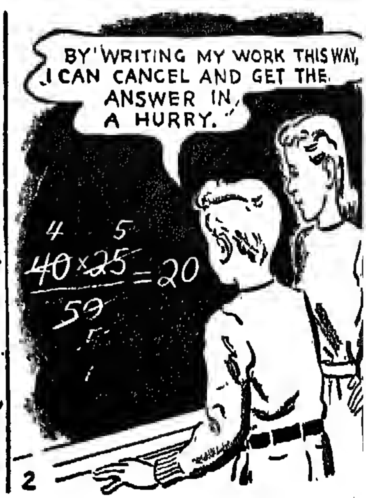
4. Which example at the right should you use to find the area in square yards of a floor that is 12 ft. wide and 18 ft. long? Copy the correct example, cancel, and find the answer. Then work the problem in the usual way to see if your answer is correct.

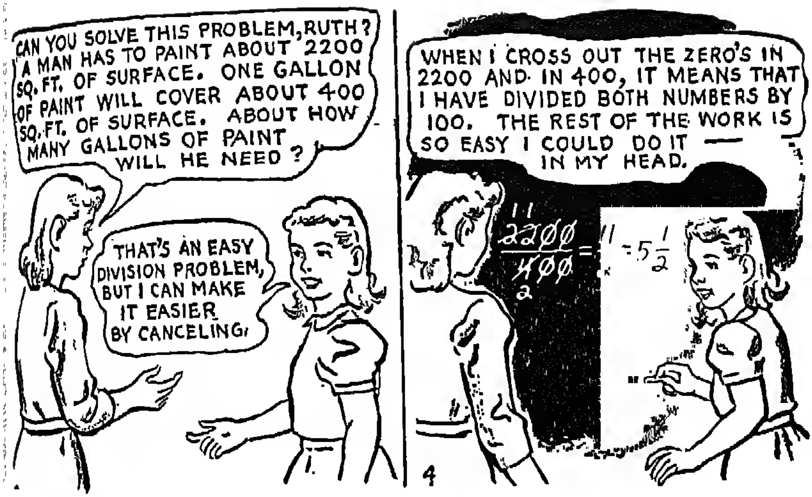
A $\dfrac{12 \times 18}{9}$

B $\dfrac{9 \times 12}{18}$

C $\dfrac{2}{12 \times 18}$







5. Which number should be used as the divisor in the problem in Picture 3 above? Solve this problem by division.

6. Does the fraction that Ruth wrote in Picture 4 show the correct division? How do you know?

7. Ruth crossed out __ zeros in 2200 and __ zeros in 400. This shows that she divided both of these numbers by __. It would have been incorrect to cross out two zeros in 2200 and only one zero in 400. Why?

8. Explain how Ruth got $5\frac{1}{2}$. Is her work correct?

9. The town of Twin Oaks has a population of 1500. During a drive, the town gave $3750 to the Red Cross. Find the average amount given per person.

After you have written the fraction for Problem 9, why can you cross off only one zero in each number? When you cancel, you can start dividing with 3, 5, 15, 25, or 75. Try each of these; then decide which of these numbers is best to use. Give a reason for your answer.

10. Is Bill's work correct in Picture 5? How did he know that the approximate answer was 25%, not 26%?

11. What word in this picture tells you that Bill was to find an approximate answer?

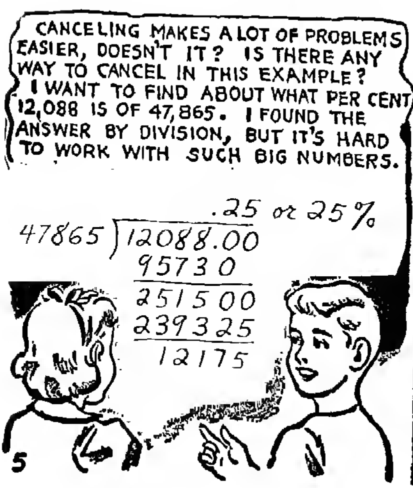
12. In Picture 6, Ruth rounded off the numbers to the nearest ___. Did she do this correctly?

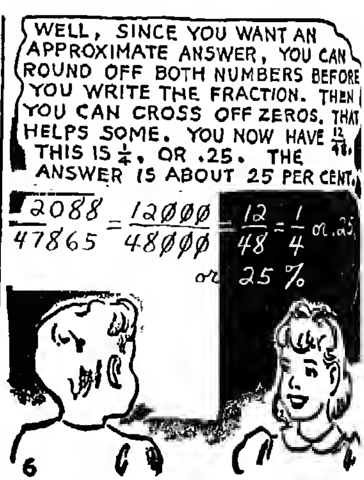
13. She crossed off ___ zeros in each number to show that she divided each number by ___. How did crossing off the zeros make the work easier?

14. If Ruth had rounded off the numbers to the nearest ten, how many zeros should she have crossed off in each number? Why? Would this make the division much easier than it was for Bill? Why?

15. The population of Troy is 350,846. The population of Ogden is 297,114. The population of Troy is approximately ___% of the population of Ogden.

To solve Problem 15, should you round off the numbers to the nearest ten, the nearest hundred, or the nearest thousand? Why? What do you do next?





Using the Short Cuts in Problems

When you solve the problems below, use the short cuts you studied on pages 340 to 342.

1. Robert earned \$2.25 for 3 hours' work. At this rate, how much would he earn in a 40-hour week?

2. In 1947 Miss Nelson's salary was \$2250. The first year she worked, her salary was \$1250. Her 1947 salary was what per cent of her first year's salary?

3. A school club had 300 movie tickets to sell at 10¢ each. 20 pupils divided the tickets evenly among themselves. Jim was the first pupil to sell all his tickets. How much money should he have turned in?

4. Miss Lyle used \$192 of her \$975 savings to pay a hospital bill. Approximately what fraction of her savings did she use to pay this bill?

In Problem 4 does it matter whether you round off the numbers to the nearest ten or to the nearest hundred? Why?

5. Mr. Stewart earns \$1.12 an hour and works 8 hr. every day. Last week he earned a total of \$44.80. How many days had he worked?

How do you know that \$44.80 is not the divisor in Problem 5? Your work will be easier if you change \$1.12 and \$44.80 to cents before you cancel.

6. On a certain job a man inspected 120 machine parts in 4 hours. At this rate, how many such parts could he inspect in a working week of 40 hours?

7. Last year Mr. Gibbons used 11 tons of coal that cost \$13.80 per ton to heat his house. What was the average cost per month for heating his house?

Interesting Measures

Many measures are important only to persons who use them frequently; but you should understand what they mean, since you will often read about them.

1. A newspaper or magazine might say: "A price of \$350 per *front foot* was paid for the property." This means that the property cost \$350 for each foot of land facing the street, no matter whether the property was 100′ deep, 120′ deep, or any other depth. At \$350 per front foot, find the cost of a lot that is 50′ wide facing the street and 100′ deep.

2. By our way of figuring time, the first *century* was from the beginning of the year 1 through the year 100. The second century was from the year __ through the year __.

3. The __ century was from the year 1501 through the year 1600. We are living in the __ century.

4. The twenty-first century will begin Jan. 1, __.

5. You should never say that a ship travels at so many miles per hour. Instead, always give its speed in *knots*. A knot is a rate of 1 *nautical* mile per hour. On page 98 you learned that a nautical mile is approximately 6080 ft. A ship traveling at 15 knots is traveling at a speed equal to $\frac{15 \times 6080}{5280}$ land miles per hour. This is approximately __ land miles per hour.

6. Of course sailors never bother to work out a ship's speed in land miles. A speed of 20 knots is just as clear to them as a speed of 35 miles an hour is to you. Approximately how many land miles an hour is a ship traveling if it is traveling at 20 knots?

7. Linoleum is made in different widths, but it often is sold by the *running foot,* or the *linear foot.* One kind of linoleum, 6 ft. wide, costs 41¢ per running foot, or 41¢ for a strip 6 ft. wide and 1 ft. long. Another kind, 9 ft. wide, costs 55¢ per running foot, or 55¢ for a strip __ ft. wide and __ ft. long.

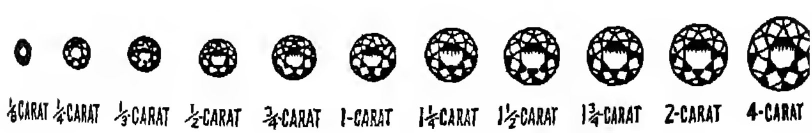
8. You can compare the prices of the two kinds of linoleum by first finding the cost of each kind per square foot. How do you know that the first kind costs about 7¢ per square foot? The second kind costs about __¢ per square foot. Which kind of linoleum is the more expensive?

9. Pure gold is called *24-carat* gold by jewelers. However, pure gold is too soft for jewelers to use; so other metals are mixed with it to give it hardness. If the pure gold in a piece of jewelry is $\frac{18}{24}$ of all the metal in the piece, the gold is called 18-carat gold. How do you know that in an 18-carat gold ring 75% of the metal used in the ring is pure gold?

10. In a 14-carat gold chain, $\frac{14}{24}$ of the metal used in the chain is pure gold. This is about __%.

11. The carat is also a measure of weight for precious stones, such as diamonds. When used in this way, a carat is equal to $\frac{1}{5}$ of a gram. A $\frac{1}{4}$-carat diamond weighs what fraction of a gram?

12. The picture below shows different sizes of diamonds. The largest diamond shown weighs __ carats more than the smallest diamond. The largest diamond weighs __ times as much as the smallest.



Learning through Practice

Add:

1.	\$57.04 86.52 73.76 88.47	$85\frac{4}{5}$ $89\frac{3}{4}$ 99	31999 23296 84757	458 $961\frac{5}{8}$ $165\frac{3}{4}$ $304\frac{1}{2}$	12.67 43.72 5.57 38.34	$92\frac{1}{12}$ $97\frac{2}{3}$ $66\frac{5}{12}$

Subtract:

2.	78756 70928	116003 41480	$84301\frac{1}{6}$ $29068\frac{2}{3}$	1.0228 .9575	$62064\frac{3}{4}$ $7810\frac{1}{3}$
3.	1957 $254\frac{4}{5}$	$1601\frac{1}{2}$ $837\frac{3}{5}$	509.23 209.14	85.000 84.981	3828 1842

Divide:

4. $80\overline{)28.8}$ $170\overline{)4.5731}$ $3.75\overline{).6}$ $15\overline{)58530}$

5. $.093\overline{).31}$ $.361\overline{)3.394}$ $169\overline{)500}$ $91.03\overline{)2.5}$

6. The interest on \$250 at 6% for 27 mo. is \$__.
7. The interest on \$600 at $4\frac{1}{2}$% for 8 mo. is \$__.
8. The interest on \$2450 at $2\frac{1}{2}$% for 6 mo. is \$__.
9. The interest on \$72 at 5% for $1\frac{1}{2}$ yr. is \$__.
10. The interest on \$400 at $1\frac{1}{2}$% for 3 mo. is \$__.
11. The interest on \$142 at $4\frac{3}{4}$% for 9 mo. is \$__.
12. $66\frac{2}{3}$% of \$810 is \$__.
13. 61.2 is __% of 340.
14. $6\frac{1}{2}$% of 964 is __.
15. 106% of \$950 is \$__.
16. $\frac{1}{6}$% of \$90 is \$__.
17. 150% of \$9.50 is \$__.
18. 216 is __% of 3600.
19. 13 is __% of 325.
20. 28% of 572 is __.
21. \$3.50 is __% of \$175.

Problems for Good Thinkers

1. Which will take more woven wire, a fence for a flower bed 4 ft. square or a fence for a circular flower bed 4 ft. in diameter? You should be able to answer this question without using pencil and paper.

2. How far from the ground is the center of a wagon wheel whose diameter is 3 ft.?

3. John's bicycle wheel, including the tire, has a radius of 14 inches. What distance on the ground will this wheel travel when it revolves once?

4. Henry's bicycle wheel, including the tire, has a diameter of 26 inches. What distance on the ground will it travel when it revolves once?

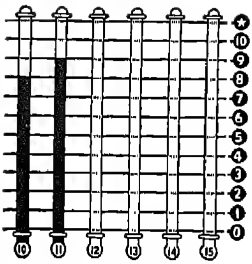
5. Is it possible for June to cut a pie into unequal pieces that contain the following number of degrees: 90°, 60°, 80°, 45°, and 120°? Explain your answer.

6. A diagram is drawn to the scale $1'' = 4'$. To make a larger diagram of the same object, which of the following scales would you use: $\frac{1}{2}'' = 4'$, $1'' = 2'$, or $\frac{1}{2}'' = 2'$? Explain your answer.

7. On a map with a scale of $\frac{1}{4}$ in. = 50 mi., Derby and Atwood are $1\frac{1}{4}$ in. apart. On another map with a scale of $\frac{1}{8}$ in. = 50 mi., would these two cities be more than $1\frac{1}{4}$ in. or less than $1\frac{1}{4}$ in. apart?

8. Two cities are 1000 mi. apart. How far apart should they be on a map with a scale of $\frac{1}{8}$ in. = 100 mi.? Why can you find the answer by finding $10 \times \frac{1}{8}$?

9. When a ladder is leaned against the side of a building, what kind of triangle is usually formed?



Self-Testing Drill 12

You will have exactly *20 minutes* for this drill. If you finish before the time is up, try "A Side-Trip in Mathematics" on pages 349 and 350.

1. Two thirds plus three fourths plus one sixth equals what?

2. Find the difference between 9,942,970 and 3,246,919.

3. How much is 18 times $2\frac{5}{6}$?

4.
6 yd. 2 ft.
2 yd. 1 ft.
1 yd. 1 ft.
5 yd. 2 ft.

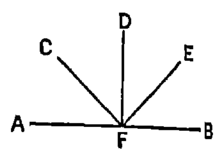
5. Subtract:
1551311.0
898752.3

6. Find 300% of 310.

7. $21.7\overline{)776.86}$

8. What must be added to $28\frac{3}{4}$ to make $76\frac{4}{5}$?

9. Which line in the diagram at the right is perpendicular to line *AB*?



10. $98 \times 8605 =$

11. 3×2346 ft. = __ mi. __ ft.

12. Find the total:
\$1.13
9.98
8.55
2.32
7.98
2.57
2.98

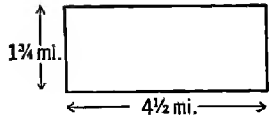
13. Find the average:
354
425
332
13
147
654
525

14. 84 is what per cent of 1680?

15. (*a*) 16 yd. = __ ft.
(*b*) 27 in. = __ ft.
(*c*) $1\frac{1}{2}$ mi. = __ ft.
(*d*) 4 ft. = __ in.

16. 228 is __% of 3800.

17. At the right is a diagram of a farm. Find its area in square miles.



18. (*a*) 1 pk. 2 qt. = __ qt.
(*b*) 1 ft. 9 in. = __ in.
(*c*) 1 yd. 1 ft. = __ ft.

19. Find the average:

$5.09
7.11
3.88
2.92
7.44

20. $682\overline{)62051}$

Examples 15 and 18 are wrong if any part is wrong.

Standards for Self-Testing Drill 12

Number Correct	0	1–3	4–5	6	7	8	9	10–11	12–13	14–15	16–19	20
Rating	0	1	2	3	4	5	6	7	8	9	10	★

A Side-Trip in Mathematics

In Example A, $25 \div 8\frac{1}{3}$ is written as a fraction. Read it, "25 *over* $8\frac{1}{3}$."

A

$$25 \div 8\frac{1}{3} = \frac{25}{8\frac{1}{3}}$$

$$\frac{25 \times 3}{8\frac{1}{3} \times 3} = \frac{75}{25} = 3$$

You know that if you multiply the numerator and the denominator of a fraction by the same number, you do not change the value of the fraction. So in the fraction 25 over $8\frac{1}{3}$ you can multiply both 25 and $8\frac{1}{3}$ by 3 without changing the value of the fraction. You multiply by 3 because 3 is the denominator of the $\frac{1}{3}$ in $8\frac{1}{3}$. When you multiply by 3, you get rid of the fraction.

1. Is the answer for $75 \div 25$ the same as the answer for $25 \div 8\frac{1}{3}$? Divide 25 by $8\frac{1}{3}$ to be sure.

2. To divide 116 by $6\frac{3}{4}$, using whole numbers, first write the fraction __ over __. Multiply both the 116 and the $6\frac{3}{4}$ by 4. Why do you use 4? Why would it not help much to multiply by 2? $4 \times 116 =$ __. $4 \times 6\frac{3}{4} =$ __. What do you do next? $116 \div 6\frac{3}{4} =$ __.

B

$$\frac{12\frac{3}{4} \times 8}{5\frac{5}{8} \times 8} =$$

$$\frac{102}{45} = 2\frac{4}{15}$$

3. In Example B, $12\frac{3}{4}$ divided by $5\frac{5}{8}$ is shown as the fraction __ over __. Try multiplying each of these mixed numbers by 4. Do you get rid of both fractions? Now try multiplying each of them by 8. What happens? Should you use 4 or 8 for the multiplier? How is the $2\frac{4}{15}$ found? Is it the correct answer?

Do each example below in the way explained above. To check your work, divide in the way you usually do.

4. $25\frac{1}{4} \div 7\frac{1}{2}$ 5. $39 \div 6\frac{1}{2}$ 6. $15\frac{3}{4} \div 2\frac{1}{4}$ 7. $5\frac{5}{6} \div 1\frac{1}{3}$

Think before You Answer

1. Is it correct to say that a camera picture of a design is a scale drawing of the design? Why do you think so?

2. Which triangles below may also be acute triangles? Which may also be obtuse triangles? Which may also be right triangles?

Equilateral Isosceles Scalene

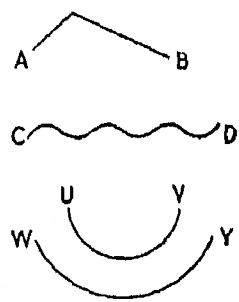
3. Which triangles below may also be equilateral triangles? Which may also be isosceles triangles? Which may also be scalene triangles?

Acute Obtuse Right

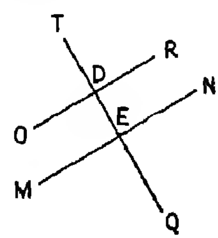
Checking Up

If you can do the work on this page and the next page, you are ready for Chapter 7.

1. Find the interest on \$750 at $5\frac{1}{2}\%$ for 30 mo.
2. A trapezoid may have how many equal sides? Can its sides all be different in length?
3. A parallelogram has __ pairs of equal sides.
4. What number may you use for the value of π?
5. Jean drew a circle with the points of her compasses set 2″ apart. How long was the diameter?
6. The circumference of the circle Jean drew was __″.
7. Line AB at the right is a __ line.
8. Line CD is a __ line.
9. Are lines UV and WY parallel? Why is it hard to find out?
10. Find the perimeter of a square 4′ 4″ on a side.
11. Write the formula for finding the circumference of a circle.



12. A triangle has two equal sides. Is it an equilateral, an isosceles, or a scalene triangle? Can it be a right triangle?
13. A triangle that has a 90° angle is called a __ triangle.
14. A scalene triangle has __ equal sides.
15. In the figure at the right which line is parallel to line OR? Name the right angles in the figure.



16. The opposite sides of a figure are equal and are also parallel. The figure is a __.

17. The figure in Exercise 16 has four right angles. Now you know that the figure is also a __.

18. The figure in Exercise 16 also has four equal sides. The figure is also a __.

19. At nine o'clock the hands of a clock are __ to one another.

20. 800 is what per cent of 4800?

21. An acute angle is an angle less than __°.

22. A __ angle is equal to two right angles.

23. An obtuse angle is more than __° and less than __°.

24. A __ angle is more than 180° but less than 360°.

25. $A=s^2$ is the formula for finding what?

26. On a scale of $\frac{1}{4}''=15'$, $1''$ represents __$'$.

27. A triangle has one angle of 47° and another angle of 53°. What is the size of the third angle?

28. Is the triangle in Exercise 27 an acute, right, or obtuse triangle? How do you know?

29. Find the interest on a note for \$250 if the rate is 4% and the time of the note is 90 days.

30. Change each per cent below to a decimal.

190%	$33\frac{1}{3}$%	$5\frac{1}{4}$%	350%	$\frac{1}{2}$%	20%

31. Change each decimal below to a per cent.

.0425	$.66\frac{2}{3}$	.125	.005	1.56

32. \$157.50 is $\frac{9}{10}$ of what amount?

33. $\frac{7}{8}$ of \$88.64 is \$__.

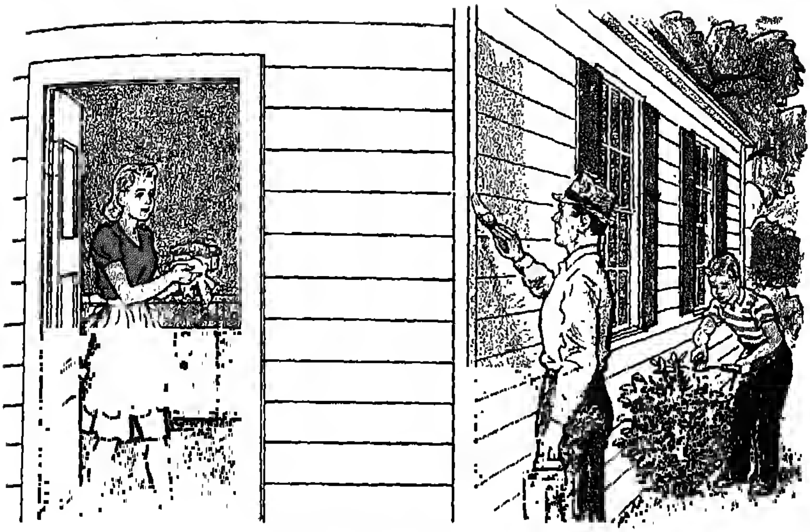
34. $\frac{3}{4}$% of \$120 is \$__.

35. 174 is __% of 5568.

36. 18 is .6 of __.

37. 325% of 96 is __.

38. 625 is __% of 25.



CHAPTER 7

Working in the Home

Mathematics in Home Jobs

In pioneer days members of the family did almost all the work around the home. The women spun yarn and wove cloth, cooked, sewed, and mended, while the men built and repaired the houses, sowed the fields, harvested the crops, and cared for the animals. If a man had some special trade, such as blacksmithing, he frequently helped his neighbors with jobs they could not do for themselves.

Today such specialized jobs as spinning and weaving are done in factories, but in every well-managed home there is still much work that is divided among the members of the family. The picture shows some of the jobs that different members of the Perry family take care of regularly. What are these jobs?

In most homes the mother and daughters do the cooking, sewing, and cleaning. The work of caring for the furnace and yard, cleaning snow from walks, cutting the grass, painting, and repairing is often divided among the father and sons.

Sometimes even the larger jobs of painting, papering, electrical repair, and building repair are done by the father with the help of the rest of the family. In many homes, however, these jobs are handled by decorators, electricians, and carpenters. As a rule, men with special training can do such work more quickly and efficiently than the average person can; but of course the cost is greater.

All the work done around the home, whether it is done by family members or by outsiders, requires a knowledge of mathematics. Everyone who cooks uses fractions. Anyone who sews soon discovers that much careful measurement is needed. The person who does carpentry about the home must know how lumber is measured, what sizes it comes in, what kinds are best for particular purposes, and how it is sold. Before anyone can paint a wall or a ceiling, he must be able to figure its area so that he can order enough paint, but not too much, for the area he wants to cover.

A farmer planning a new barn must know how many animals he will need shelter for and how much room to allow for each one. He also must know how much feed they will eat and what space will be needed to store this feed. Before he can figure these things, he must know how to find areas and capacities.

In this chapter you will learn more about such mathematics and how it is used in work around the home.

1. What are your regular jobs around your home? Do you ever use any mathematics when you do these jobs? If so, give examples.

2. Give some examples of the mathematics your mother uses when she does her housework.

3. Describe some work done around your home in which it was necessary to measure distances.

4. Is it ever necessary to weigh things in the home? If so, when is it necessary?

5. In your home has it ever been necessary to draw circles, triangles, or squares? If so, give some examples.

6. In many kinds of work around the home it is necessary to know how to find the areas of different figures. Give several examples of this.

7. Have you a hobby? If so, give some examples of the mathematics you use in it.

8. When your father works around the home, does he use any mathematics that you do not understand?

9. How is mathematics used in operating an automobile?

10. How are the mathematics problems found in cooking different from those found in sewing?

11. Who would be most likely to make the greatest use of scale drawing, a carpenter, a painter, or an architect? Why do you think so?

12. Which linear measurement, the inch, the foot, the yard, or the rod, is most used in work around your home? Why is this true?

13. When is the rod used in measurement?

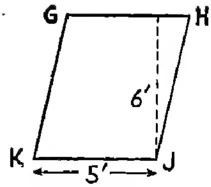


FIGURE 3

10. You can also use a formula to find the area of a parallelogram. This formula is $A = bh$. It means that the area is equal to *the base times the height.* Why can you also use this formula to find the area of a rectangle?

11. Study Example A and the explanation that follows to see how the formula is used to find the area of parallelogram *GHJK* above.

The base of this parallelogram is line *KJ*. How long is the base?

The dotted line is perpendicular to line ___. How do you know that the dotted line is the height of the parallelogram? The parallelogram is ___ ft. high.

Since the base is 5′ and the height is 6′, then the area equals $b \times h$, or 5×6, or ___. How do you know that the answer means square feet?

A

$A = bh$

$A = 5 \times 6$

$A = 30$, or

30 sq. ft.

12. In Example B the formula is used to find the area of Figure 4 below. Is this figure a parallelogram? Is it a rectangle? How do you know?

Why is 10 used for *b*? Why is $3\frac{1}{2}$ used for *h*? What is the area of Figure 4?

B

$A = bh$

$A = 10 \times 3\frac{1}{2}$

$A = 35$, or

35 sq. in.

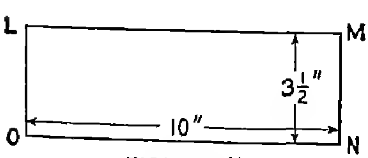


FIGURE 4

The area of any parallelogram can be found by multiplying its base by its height. The formula $A = bh$ may be used to find its area.

13. Find the areas of Figures 5, 6, and 7 below; then check your work with that in Self-Help Examples C to E.

When you find the area of Figure 5, why do you use 4 and not 5 for *h*?

In finding the area of Figure 6 in square inches why do you use 12 for *h*? To find the area of Figure 6 in square feet, why should you use $1\frac{1}{3}$ for *b*? What should you use for *h*?

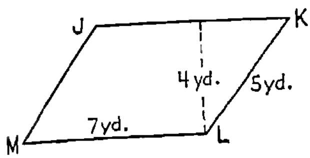


FIGURE 5

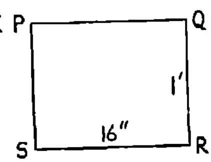


FIGURE 6

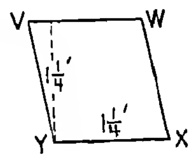


FIGURE 7

C	D	E
$A = bh$	$A = bh$	$A = bh$
$A = 7 \times 4$	$A = 16 \times 12$	$A = 1\frac{1}{4} \times 1\frac{1}{4}$
$A = 28$, or	$A = 192$, or	$A = 1\frac{9}{16}$, or
28 sq. yd.	192 sq. in.	$1\frac{9}{16}$ sq. ft.

14. Now find the area of each figure below. Remember that the two dimensions should be in the same unit of measure before you multiply.

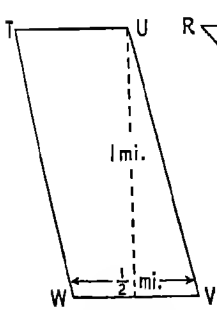


FIGURE 8

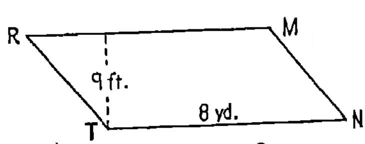


FIGURE 9

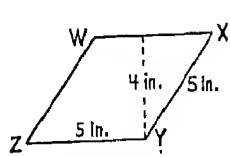


FIGURE 10

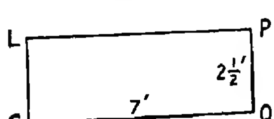


FIGURE 11

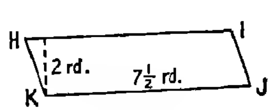
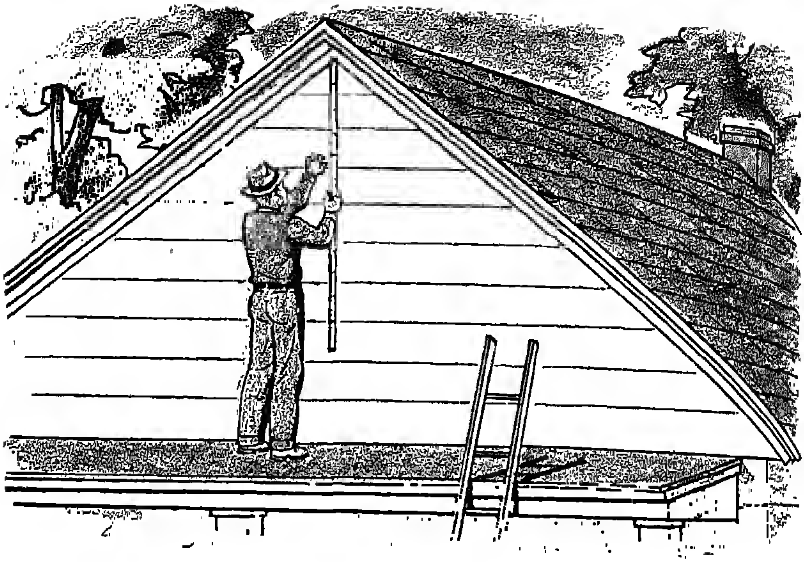


FIGURE 12



Area of a Triangle

Before Mr. Davis could order the paint he needed for the outside of his house, he had to know how many square feet of surface were to be covered. When Judy wondered how her father could find the area of the gable, which is triangular in shape, Mr. Davis said, "To find the area, I must know two dimensions. They are the *base* and the *height*. I'll measure them now."

After he had measured the base and the height, he drew the diagram at the right to show Judy what he meant by the two dimensions of a triangle. The base of a triangle is the side on which it seems to rest. The base of the gable measured __ ft. The height of a triangle is the perpendicular distance from its base to the vertex of the angle opposite its base. The height of the gable measured __ ft.

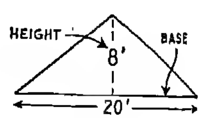


FIGURE 1

You will sometimes read or hear of the *altitude* of a figure. The word "altitude" means "height." What was the altitude of the gable?

Mr. Davis told Judy that the area of a triangle is equal to one half the area of a parallelogram with the same base and the same height. He drew Figure 2 to show her why this is true.

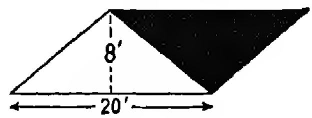


FIGURE 2

The white part of Figure 2 is the same triangle shown in Figure 1 on page 360. The black part is another triangle exactly like the white one in shape and size.

1. How are the positions of the triangles different?

2. The two triangles together form a parallelogram. How do you know this is true?

3. The base of the parallelogram is _′. Is this the same as the base of the triangle in Figure 1? What is the height of the parallelogram? Is this the same as the height of the triangle in Figure 1?

4. Using the formula $A=bh$ to find the area of the parallelogram, what do you use for b? For h? The area of the parallelogram is _ sq. ft.

5. How does Figure 2 show that the area of the triangle in Figure 1 is one half the area of the parallelogram?

6. The area of the triangle is $\frac{1}{2}$ of _ square feet, or _ sq. ft. What is the area of the gable?

The formula for finding the area of a triangle is $A=\frac{1}{2}bh$. It means that the area is equal to $\frac{1}{2}$ *times the base times the height.*

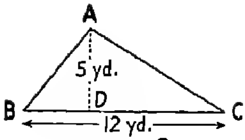


FIGURE 3

7. Study Example A and the explanation that follows to see how the formula is used to find the area of triangle ABC at the left.

Line BC is the base of this triangle. How long is the base?

Line AD is drawn from the vertex opposite the base and is perpendicular to the base. So line AD shows the height of the triangle. The height is ___ yd.

Since the base is 12 yd. and the height is 5 yd., use 12 for b in the formula and 5 for h.

The canceling shown in Example A makes the work easier.

How do you know that the answer 30 means square yards?

A

$$A = \frac{1}{2}bh$$

$$A = \frac{1}{2} \times 12 \times 5$$

$$A = \frac{1}{\underset{1}{\cancel{2}}} \times \overset{6}{\cancel{12}} \times 5 = 30,$$

or 30 sq. yd.

8. In Example B the formula is used to find the area of Figure 4 below. How do you know that triangle EFG is a right triangle?

B

$$A = \frac{1}{2}bh$$

$$A = \frac{1}{2} \times 14 \times 6$$

$$A = \frac{1}{\underset{1}{\cancel{2}}} \times \overset{7}{\cancel{14}} \times 6 = 42,$$

or 42 sq. in.

Line ___ is the base of this triangle. How do you know that line EG, which is a side of the triangle, is also the height of the triangle? The base of triangle EFG is ___ inches. The height of the triangle is ___ inches.

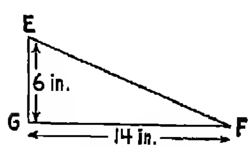


FIGURE 4

What canceling is done? Is the work correct?

The area of triangle EFG is ___ sq. in.

9. Find the areas of Figures 5, 6, and 7 below. The work in Self-Help Examples C, D, and E will help you if you have trouble.

Why do you use 36 for *h* when you find the area of Figure 5?

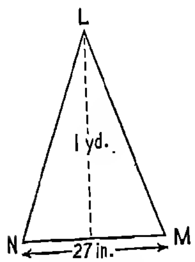


FIGURE 5

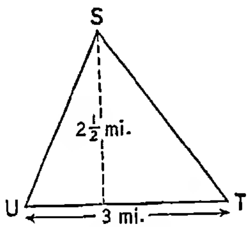


FIGURE 6

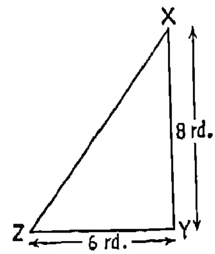


FIGURE 7

C	D	E
$A = \frac{1}{2}\ bh$	$A = \frac{1}{2}\ bh$	$A = \frac{1}{2}\ bh$
$A = \frac{1}{2} \times 27 \times 36$	$A = \frac{1}{2} \times 3 \times 2\frac{1}{2}$	$A = \frac{1}{2} \times 6 \times 8$
$A = \frac{1}{\cancel{2}_{1}} \times 27 \times \cancel{36}^{18} = 486,$	$A = \frac{1}{2} \times 3 \times \frac{5}{2} = \frac{15}{4},$	$A = \frac{1}{\cancel{2}_{1}} \times \cancel{6}^{3} \times 8 = 24,$
or 486 sq. in.	or $3\frac{3}{4}$ sq. mi.	or 24 sq. rd.

10. Find the area of each triangle below. Should you use $3\frac{1}{2}$ or 4 for *h* in Figure 9? Why? Should you use 4 or 5 for *b* in Figure 10? Why?

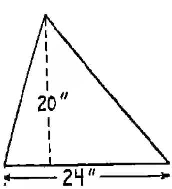


FIGURE 8

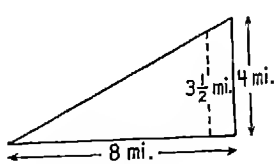


FIGURE 9

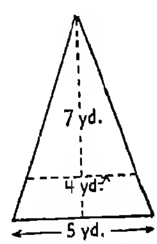


FIGURE 10

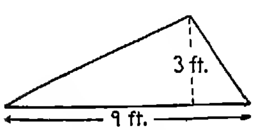


FIGURE 11

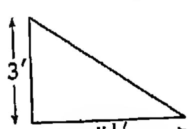


FIGURE 12

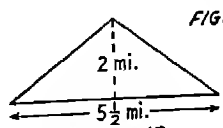


FIGURE 13

Area of a Trapezoid

Mr. Gilbert plans to resod his lawn. In the picture he and Roy are measuring the lawn so that they can find the area and figure how much sod to buy.

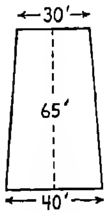


FIGURE 1

1. Mr. Gilbert drew the diagram of the lawn shown in Figure 1. How do you know that the lawn is a trapezoid and not a parallelogram?

2. Mr. Gilbert marked three dimensions on the diagram because he had to know three dimensions to find the area of the lawn. The two parallel sides of a trapezoid are called its *bases*. The bases of the lawn are —′ and —′.

3. The dotted line on the diagram shows the *height* of the trapezoid. Notice that this line is perpendicular to each base. *The height of a trapezoid is the perpendicular distance between the two bases.* The height of the trapezoid is —′.

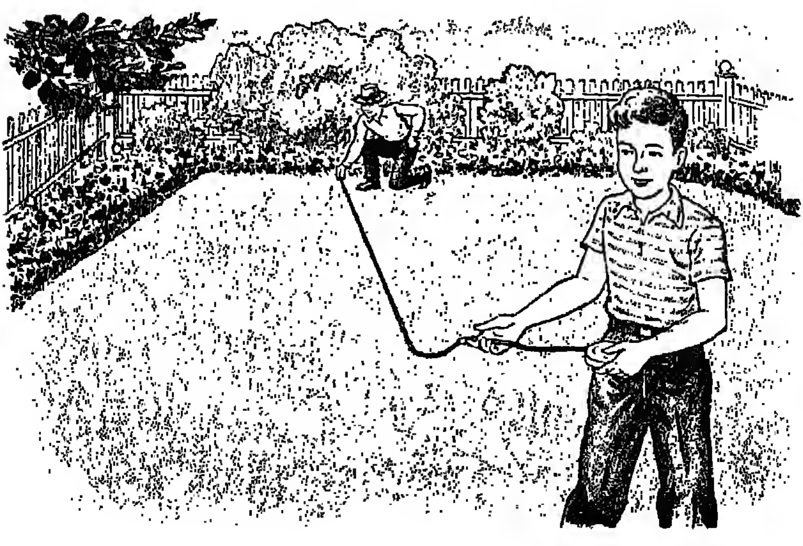


Figure 2 and the work that follows will show you one way to find the area of the lawn.

In Figure 2 the white part is a trapezoid like the one in Figure 1. The black part is another trapezoid exactly like the white one in shape and size.

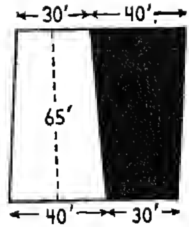


FIGURE 2

4. How is the position of the black trapezoid different from the position of the white trapezoid?

5. The two trapezoids together form a parallelogram. How do you know Figure 2 is a parallelogram? Do the trapezoids form a rectangle? How do you know?

6. What line shows the height of the parallelogram? Is this the same as the height of the trapezoid in Figure 1? How do you know?

7. The height of the parallelogram is __ ft.

8. The base of the parallelogram is equal to the sum of both bases of the trapezoid in Figure 1. How do you know that this is true?

9. The base of the parallelogram is __ ft. plus __ ft., or __ ft.

10. In finding the area of the parallelogram, what do you use for b? For h? What is the area?

11. The area of the trapezoid in Figure 1 is one half the area of the parallelogram. Why? The area of the trapezoid is $\frac{1}{2}$ of 4550 sq. ft., or __ sq. ft.

12. Mr. Gilbert should buy __ sq. ft. of sod.

13. Use the method explained above to find the area in square inches of the trapezoid in Figure 3 at the top of page 366.

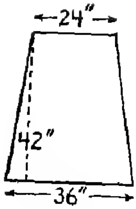


FIGURE 3

14. Study Example A below to see how a formula is used to find the area of the trapezoid in Figure 3. The first b in the formula represents one base. The other b, with the little mark after it, represents the other base. It is read b *prime.*

The formula means that *the area of a trapezoid is one half the area of a parallelogram whose base is equal to the sum of both bases of the trapezoid and whose height is equal to the height of the trapezoid.*

A

$A = \frac{1}{2}(b + b')h$

$A = \frac{1}{2}(24 + 36)42$

$A = \frac{1}{2}(60 \times 42)$

$A = \frac{1}{2} \times 2520$

$A = 1260$, or

1260 sq. in.

The parentheses around the b and b' show that you are to find the sum of the bases before you do any other figuring.

When you rewrite the formula, use the dimensions instead of b, b', and h. 24 is used for b. 36 is used for b'. 42 is used for h.

Next find the sum of b and b'. Why? $24+36=60$.

Now multiply the sum of b and b' by 42. Is 2520 correct?

Finally, find $\frac{1}{2}$ of 2520. Is the answer 1260 sq. in. correct?

B

$A = \frac{1}{2}(b + b')h$

$A = \frac{1}{2}(36 + 42)30$

$A = \frac{1}{2}(78 \times 30)$

$A = \frac{1}{2} \times 2340$

$A = 1170$, or

1170 sq. ft.

15. Example B shows how to find the area of Figure 4. The bases of this trapezoid are __′ and __′. The height is __′.

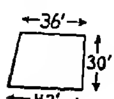


FIGURE 4

What is used for b? For b'? For h?

How do you get the 78? The 2340? Is the answer 1170 sq. ft. correct?

16. Self-Help Examples C, D, and E will help you to find the areas of Figures 5, 6, and 7 below. In Figure 6 why do you use $1\frac{1}{2}$ instead of $1\frac{3}{4}$ for h? Do you use 32 or 36 for h in Figure 7? Why?

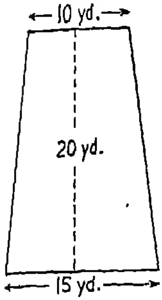


FIGURE 5

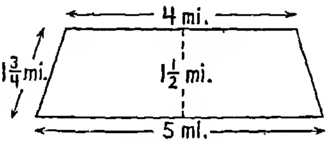


FIGURE 6

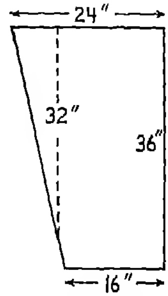


FIGURE 7

C	D	E
$A=\frac{1}{2}(b+b')h$	$A=\frac{1}{2}(b+b')h$	$A=\frac{1}{2}(b+b')h$
$A=\frac{1}{2}(10+15)\,20$	$A=\frac{1}{2}(4+5)\,1\frac{1}{2}$	$A=\frac{1}{2}(24+16)\,36$
$A=\frac{1}{2}(25\times 20)$	$A=\frac{1}{2}(9\times 1\frac{1}{2})$	$A=\frac{1}{2}(40\times 36)$
$A=\frac{1}{2}\times 500$	$A=\frac{1}{2}\times\frac{27}{2}$	$A=\frac{1}{2}\times 1440$
$A=250$, or 250 sq. yd.	$A=6\frac{3}{4}$, or $6\frac{3}{4}$ sq. mi.	$A=720$, or 720 sq. in.

17. Now find the area of each trapezoid below.

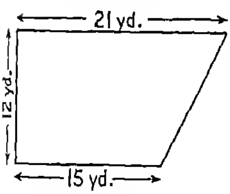


FIGURE 8

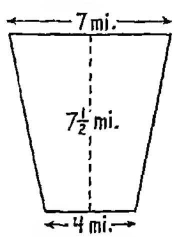


FIGURE 10

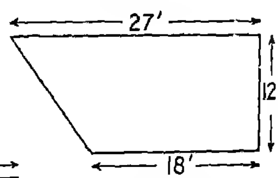


FIGURE 12

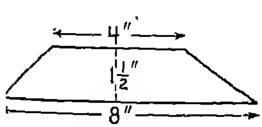


FIGURE 9

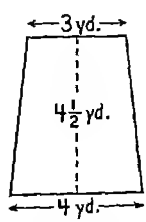


FIGURE 11

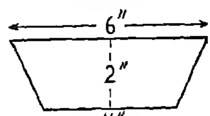
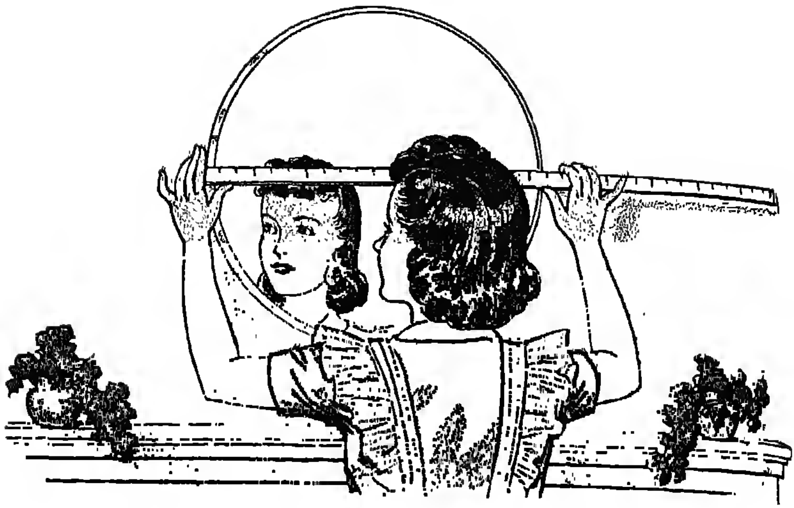


FIGURE 13



Area of a Circle

Mrs. Hood wanted to have a circular mirror resilvered. She was told that it would cost 75¢ per square foot to have this done; so she had to find the area of the mirror before she could estimate the total cost.

Mrs. Hood needed to know the radius of the mirror before she could find its area; so she measured the diameter. How did this help her find the radius?

She used a formula to find the area of the mirror. Figure 1 below and the explanation that follows will help you to understand why the formula works.

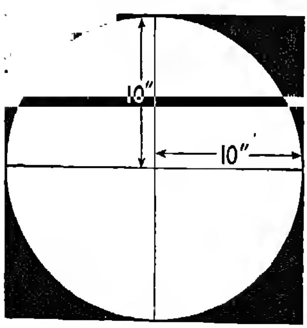


FIGURE 1

1. The white circle is a diagram of the mirror. The radius of the mirror is __ in. How many radii are shown on the diagram?

2. Notice the square that has been drawn around the circle. How do you know that each side of this square is 20 in.?

3. The four radii drawn in the circle divide it into __ equal parts. These four lines also divide the square into __ equal parts.

4. Each small square is 10 in. by 10 in. How do you know this? To find the area of one of these small squares, multiply __ by __. The area of each small square is __×__, or __ sq. in.

5. When you find the area of a small square, are you multiplying a radius of the circle by a radius of the circle? How do you know?

6. There are __ small squares in the large square. The area of the large square is 4×100, or __ sq. in.

7. Is the area of the circle larger than or smaller than the area of the large square? How do you know?

8. The area of the circle is only about 3.14 times the area of one of the small squares. The area of the circle is 3.14×100, or __ sq. in. Why do you use 100? How do you know the answer means square inches?

9. Is it correct to say that the area of the mirror is approximately $2\frac{1}{6}$ sq. ft.? In estimating the cost of resilvering, should Mrs. Hood use 2 sq. ft. or 3 sq. ft.?

10. Resilvering the mirror should cost about $__.

11. Mrs. Hood used the formula at the right to find the area of the mirror.

$$A = \pi r^2$$

Read the formula as *A = pi r square.* The *r* in the formula represents the radius. The small raised 2 means that the radius is to be multiplied by itself, or squared. What does π represent?

The formula means that *the area of a circle equals pi times the radius times the radius.*

12. Study Example A and the work that follows to see how the formula is used to find the area of Mrs. Hood's mirror.

A
$A = \pi r^2$
$A = 3.14 \times 10^2$
$A = 3.14 \times 100$
$A = 314$, or
314 sq. in.

When you rewrite the formula, you use 3.14 for π. Why?

You use 10 for r because the radius of the mirror is 10 in. The raised 2 after the 10 means that the 10 is to be multiplied by itself, or squared. $10^2 = 10 \times 10 =$ __.

$3.14 \times 100 =$ __. What is the area? Is this the same as the area you found in Problem 8?

13. In Example B the formula is used to find the area of the circle below. What dimension is marked on this circle? This is not the dimension you need to find the area. How do you find the dimension you need?

B
$A = \pi r^2$
$A = 3.14 \times 12^2$
$A = 3.14 \times 144$
$A = 452.16$, or
452.16 sq. ft.

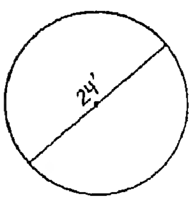


FIGURE 2

When you rewrite the formula, what do you use for π? Why is 12^2 instead of 24^2 used for r^2? What does 12^2 mean?

How do you get 144? The area of the circle is 452.16 __.

14. Now find the area of each circle in Figures 3, 4, and 5 at the top of the next page. If you have trouble finding these areas, compare your work with the work in Self-Help Examples C, D, and E. Why is 201 sq. in. a good approximate answer for the area of Figure 3? What is a good approximate answer for the area of each of the other two circles?

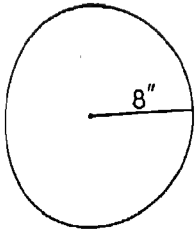


FIGURE 3

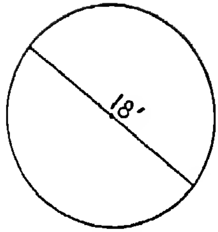


FIGURE 4

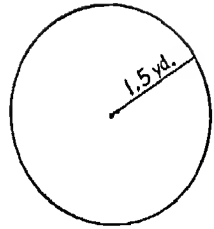


FIGURE 5

C	D	E
$A = \pi r^2$	$A = \pi r^2$	$A = \pi r^2$
$A = 3.14 \times 8^2$	$A = 3.14 \times 9^2$	$A = 3.14 \times 1.5^2$
$A = 3.14 \times 64$	$A = 3.14 \times 81$	$A = 3.14 \times 2.25$
$A = 200.96$, or 200.96 sq. in.	$A = 254.34$, or 254.34 sq. ft.	$A = 7.065$, or 7.065 sq. yd.

15. What is the area of a circular floor with a diameter of 20 ft.?

16. Find the areas represented by the eight circles below. In finding the areas of these circles, round off each answer to the nearest hundredth.

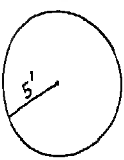


FIGURE 6

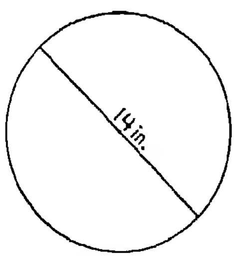


FIGURE 7

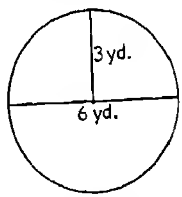


FIGURE 8

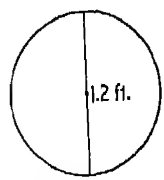


FIGURE 9

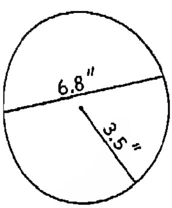


FIGURE 10

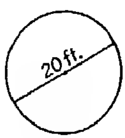


FIGURE 11

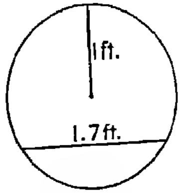


FIGURE 12

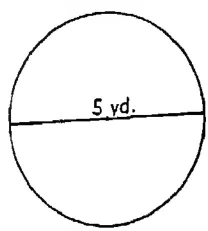


FIGURE 13

Problems on Areas

1. Mr. Brent plans to put fertilizer on his new lawn, which is a trapezoid in shape. Its bases are 70′ and 60′, and its height is 40′. He plans to use 5 lb. of fertilizer for every 100 sq. ft. of lawn. How many pounds of fertilizer will he need?

2. When Mr. Brent seeds this lawn, he will need about 5 lb. of grass seed per 1000 sq. ft. of surface. He will need about __ pounds of grass seed.

3. The sail on a boat is a triangle with a base of 6 ft. and a height of 20 ft. What is its area?

4. Before buying materials to cement the bottom of a circular pool, Mr. Ballard needs to know the area of the bottom of the pool. The radius of the pool is $7\frac{1}{2}$ ft. Find the area of the bottom of the pool.

5. A rectangular picture $3\frac{1}{4}$ in. long and $2\frac{1}{4}$ in. wide has been enlarged so that its new dimensions are just twice as long as the old ones. Can you tell, without using pencil and paper, whether or not the new area is twice the old one? Why do you think so?

6. Jim washed the walls and ceiling in the kitchen, which is 8′ wide, 10′ long, and $8\frac{1}{2}$′ high. The cupboards and doorways take up 48 sq. ft. of wall space, and the two windows measure 2′ x $4\frac{1}{2}$′ each. At 5¢ per square yard, how much money should Jim have received?

7. Make a 3-column table for your work with each figure on page 373. In the first column tell the kind of figure it is, if you can. In the second column, if you can, give the area it represents. If you cannot find an area, explain why in the third column.

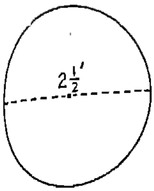


FIGURE 1

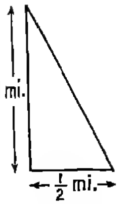


FIGURE 2

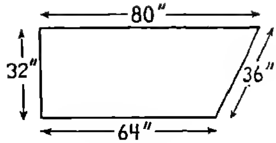


FIGURE 3

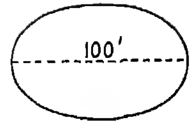


FIGURE 4

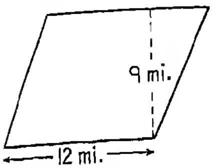


FIGURE 5

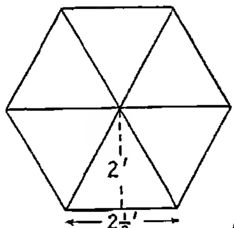


FIGURE 6

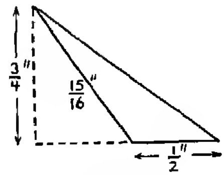


FIGURE 7

FIGURE 8

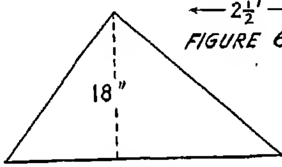


FIGURE 9

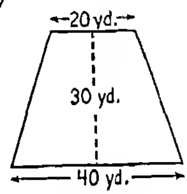


FIGURE 10

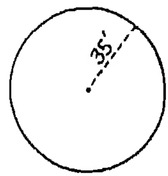
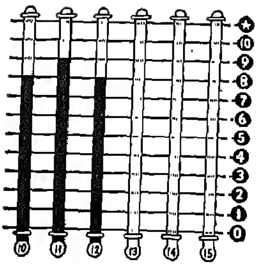


FIGURE 11

Practice with Per Cents

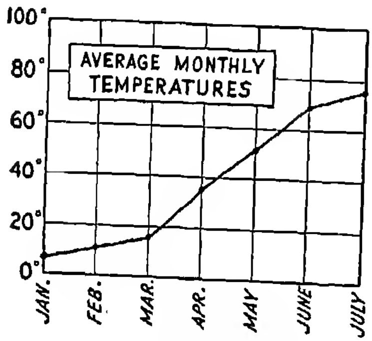
1. __% of 700 is 1400.
2. $62\frac{1}{2}\%$ of \$24.50 is \$__.
3. 140% of 255 is __.
4. \$42 is __% of \$12.
5. $\frac{1}{2}\%$ of \$17,278 is \$__.
6. __% of 111 is 148.
7. 400% of 27 is __.
8. \$36 is __% of \$45.
9. 75% of 35 is __.
10. 120 is __% of 96.
11. __% of \$75 is \$24.
12. 12% of 650 is __.
13. 225% of \$800 is \$__.
14. 60 is __% of 160.
15. __% of \$1200 is \$800.
16. 4% of \$225 is \$__.
17. 20¢ is __% of \$1.
18. $4\frac{1}{4}\%$ of \$9.98 is \$__.
19. __% of 300 is 900.
20. $2\frac{1}{2}\%$ of \$980.50 is \$__.
21. 24 is __% of 15.
22. $16\frac{2}{3}\%$ of \$550 is \$__.
23. $87\frac{1}{2}\%$ of \$144 is \$__.
24. __% of 372 is 310.
25. 12 is __% of 240.
26. 280% of 95 is __.
27. 90 is __% of 80.
28. $\frac{1}{6}\%$ of \$480 is \$__.



Self-Testing Drill 13

You will have exactly *20 minutes* for this drill. If you finish before the time is up, try "A Side-Trip in Mathematics" on page 376.

1. The graph below was made from the table of average monthly temperatures printed beside it. The temperature for one of the months is incorrectly placed on the graph. For which month is it incorrectly placed?



Month	Average Temperature
January	6°
February	11°
March	24°
April	38°
May	52°
June	68°
July	78°

2. Would a 3% discount on a sale of \$1900 be \$570, \$57, or \$5.70?

3. Subtract:
   1515562
   637938

4. Subtract:
   2 ft. 3 in.
   1 ft. 9 in.

5. $\frac{9}{10}$ of $4\frac{1}{6}=$

6. $756\overline{)375732}$

7. Divide $4\frac{3}{8}$ by $3\frac{3}{4}$.

8. Add $4\frac{3}{4}$, $\frac{2}{5}$, 6, and $2\frac{9}{10}$.

9. Find $3\frac{1}{4}\%$ of \$1200.

10. Multiply 61.72 by 8007.

11. What per cent of 150 is 129?

12. 9 lb. 4 oz. ÷ 4 =

13. $69.3\overline{)\,.4851}$

14. Find the average:

$$\begin{array}{r} 5897 \\ 563 \\ 878 \\ 8795 \\ 7866 \\ \underline{4298} \end{array}$$

15. Multiply:

$$\begin{array}{r} 914 \\ \underline{4.99} \end{array}$$

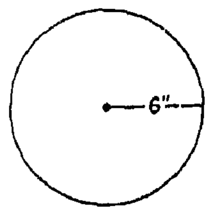
16. Multiply:

$$\begin{array}{r} 2 \text{ yd. } 1 \text{ ft.} \\ \underline{8} \end{array}$$

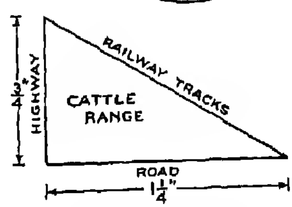
17. 25.2 is what per cent of 84?

18. (*a*) $\frac{3}{8}$ of a number equals __% of the number.
   (*b*) $.33\frac{1}{3}$ of a number equals __% of the number.
   (*c*) 4% of a number equals what decimal fraction of the number?

19. Which of the following will give the circumference of the circle at the right?
   (*a*) $\pi \times 6''$ (*b*) $\pi \times 3''$ (*c*) $\pi \times 12''$



20. The diagram of the cattle range shown at the right is drawn to a scale of *1 in.* = *4 mi.* Find the area of the cattle range in square miles.



Example 18 is wrong unless you answer all three parts correctly.

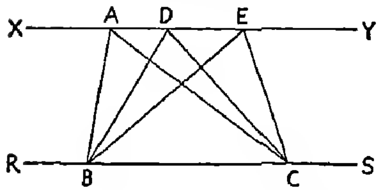
Standards for Self-Testing Drill 13

Number Correct	0	1–4	5–6	7	8	9	10	11	12–13	14–15	16–19	20
Rating	0	1	2	3	4	5	6	7	8	9	10	★

Do not forget to use your Progress Chart. Do the thermometers show that your work is improving?

A Side-Trip in Mathematics

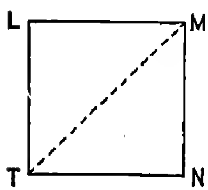
1. Do triangles *ABC*, *DBC*, and *EBC* have equal bases? How do you know?



2. Lines *XY* and *RS* are parallel. Do the three triangles have equal heights? How do you know?

3. Are the triangles equal in area? How do you know?

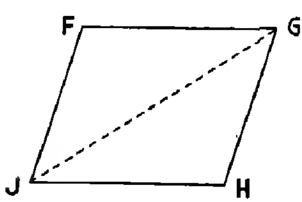
4. Is the following statement true? Triangles that have equal bases and equal heights may differ in shape, but they are always equal in area.



5. In square *LMNT* at the left, line *MT*, which joins two opposite corners, is called a *diagonal*. Is base *LM* of triangle *LMT* equal to base *TN* of triangle *MNT*? How do you know?

6. The height of triangle *LMT* is equal to the height of triangle *MNT*. How do you know?

7. How can you show that the diagonal of a square divides it into two triangles that are equal in area?



8. In parallelogram *FGHJ* the diagonal is line ___. It divides the parallelogram into what two triangles?

9. How do you know that the bases of these triangles are equal? How do you know that their heights are equal?

10. Does the diagonal of a parallelogram divide it into two equal triangles? How do you know?

Without Pencil

	A	B	C	D	E	F
1.	$\frac{68}{12}$ in simplest form is ------.	1% of 2 =	Find the average: 10, 7, 0, 4, 3, 6, 12.	$\begin{array}{r} 31 \\ 20 \\ \underline{18} \end{array}$	$100 \times .4$	Change to simplest form: 7 bu. 38 pk.
2.	$82\overline{)165}$	Subtract: $\begin{array}{r} 16.32 \\ \underline{16.30} \end{array}$	$\frac{1}{8} + \frac{5}{8}$	200% = what decimal?	How many days in 1948?	$\frac{1}{6} \div \frac{1}{5}$
3.	$\begin{array}{r} 24 \\ \underline{\times 1\frac{3}{4}} \end{array}$	.5% of 100 =	$.6\overline{)204}$	@ means ------.	$48000 \div 4000 =$	Multiply: $\begin{array}{r} 10.8 \\ \underline{8} \end{array}$
4.	3.7% = what decimal?	$\frac{4}{5} \times \frac{3}{4}$	$82.6 \div 100$	$.7 \times 3 \times 10$	$.00\frac{7}{8} =$ ---- %	$21\frac{1}{4} - 20\frac{1}{2}$

Learning through Practice

1. $.62 + .97 + 1.29 + 8.55 =$
2. $607 \times 857 =$
3. 12% of \$8.99 =
4. $150 - 78.1 =$
5. 57 is __% of 380.
6. 1.2% of 356 =
7. __% of 252 is 84.
8. $7\frac{1}{4} + 11\frac{1}{6} + 17 + 19\frac{1}{2} =$
9. 16% of 30 =
10. $\frac{1}{4}$% of \$6350 is \$__.
11. __% of 720 is 18.
12. $4087 \div 41 =$
13. 125% of 493 is __.
14. $40 \times .651 =$
15. $5\frac{1}{3} \times 6\frac{3}{10} =$
16. $236 \div 11 =$
17. $\frac{1}{2}$% of 96 =
18. $5\frac{5}{6} \times 2\frac{1}{10} =$
19. 111% of 65 =
20. $.9315 \div 5 =$
21. $33\frac{5}{6} - 33\frac{1}{4} =$
22. $35 \times 28.6 =$
23. $513 \div 72 =$
24. $.0426 \div .924 =$
25. $43.00 - 42.16 =$
26. $69\frac{3}{4} \times 601 =$

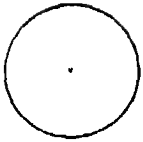


FIGURE 1

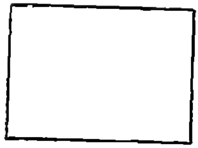


FIGURE 2

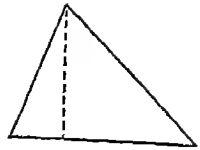


FIGURE 3

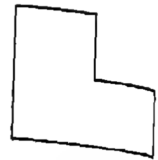


FIGURE 4

Plane Figures and Solid Figures

On pages 297-298 you studied about figures drawn on a flat surface. Such figures are called plane figures.

1. Is Figure 1 above a plane figure? Why? How do you know that Figure 1 is a circle?

2. To describe Figure 1 so completely that another person can draw it, all you need to say is that the figure is a circle with a radius of $\frac{3}{8}''$. Why is it unnecessary to say more than this?

3. Figure 2 is a __.

4. You can describe Figure 2 completely by saying that it is a rectangle and giving the length of its base and of its height. How do you know that these facts will describe the figure completely?

5. Figure 3 is a __.

6. Can you describe Figure 3 completely by saying that it is a triangle and giving the length of its base and of its height? Why or why not?

7. To describe Figure 3 so that another person can draw it, why must you give both the lengths of its three sides and the sizes of its angles?

8. You can see that Figure 4 is made up of two rectangles. If another person wanted to draw Figure 4 without looking at it, could he do so if you gave him the base and the height of each rectangle? Why?

9. Write a careful description of Figure 4. Be sure to include everything that would be needed by a person drawing the figure from your description. Use your ruler to get the dimensions of the figure.

10. You can draw a plane figure on a piece of paper, but the piece of paper itself is not a plane figure. It has *thickness*, though the thickness is too small for you to measure. The piece of paper is called a *solid*. Anything that has thickness is a solid. Another way to describe a solid is to say that it is any object that takes up room, or space. Is a pencil a solid? A hat? A shoe?

11. List ten other solids in your classroom.

12. A piece of stone and a pile of sand are both solids. Why are solids like these hard to describe completely?

13. Look at the picture on the next page. Do all these objects have length? Width? Thickness? Do all of them take up space? Each object is a __.

14. Study the first solid on page 380. What is it called? Are all the sides, or *surfaces*, rectangular in shape? How many surfaces does this solid have?

Because such rectangular solids, usually called rectangular prisms, are so common, you should be able to recognize them wherever you see them. *Any object with all its sides rectangles is a rectangular prism.* This is true even if the object is hollow or empty.

15. Which of the following are rectangular prisms: a brick, a chalk box, a fruit jar, a domino, a door?

16. Are any of the ten solids that you listed in Problem 11 rectangular prisms? If so, which ones?

17. Look at the picture of the solid marked "cube" below. How many surfaces does this solid have? Is it a rectangular prism? Why?

18. The length, width, and height of a cube are all equal. Does this mean that all six surfaces of a cube are squares? Why do you think so?

19. Are any of the ten solids that you listed in Problem 11 cubes? If so, which ones are cubes?

20. How many triangular surfaces does the triangular prism have? Does it have any surfaces shaped like a parallelogram? Are these surfaces rectangular? How many surfaces does the triangular prism have in all?

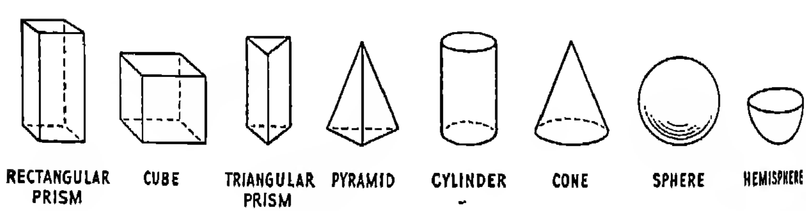
21. The pyramid below has four surfaces. _ of these surfaces are triangular. If a pyramid had five surfaces, how many of them would be triangular?

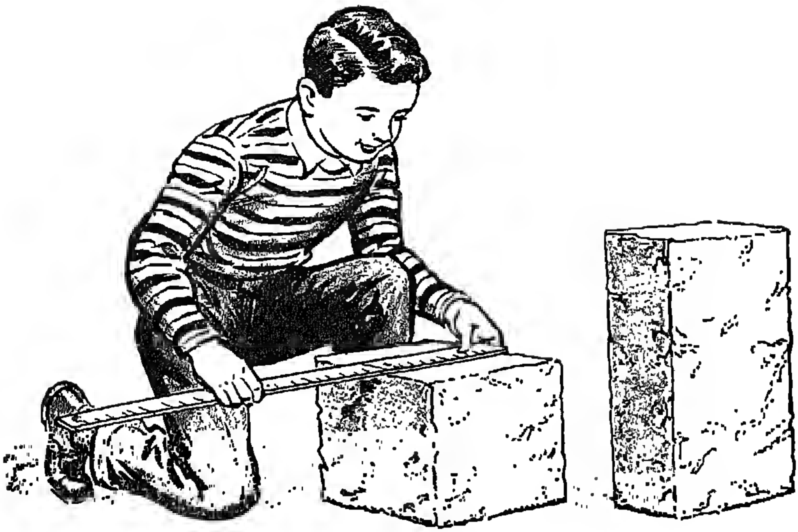
22. Rectangular prisms, triangular prisms, and pyramids have only plane surfaces. How do you know this? In the other solids below, some of the surfaces are curved. Which solids have some curved surfaces?

23. How many plane surfaces does the cylinder have? How many plane surfaces does the cone have?

24. The sphere has only one surface. Is it plane or curved?

25. "Hemisphere" means "half a sphere." Describe the surfaces of a hemisphere.





Finding Volumes and Capacities

When Bob Jensen helped his father move some building stones, he complained that they were heavy. His father said, "Find out how long, how wide, and how high a stone is, and I'll tell you its approximate weight."

The first stone Bob measured was 1 ft. long, 1 ft. wide, and 1 ft. high. His father said that this stone took up 1 *cubic foot* of space and weighed about 170 lb.

1. Another stone that Bob measured was 1 ft. long, $\frac{1}{2}$ ft. wide, and 2 ft. high. His father said, "That stone also takes up 1 cubic foot of space. It will weigh about 170 lb., too." How did he know that this stone took up the same amount of space as the first one?

2. A rectangular solid 1 in. long, 1 in. wide, and 1 in. high is called a 1-inch cube. A 1-inch cube takes up 1 *cubic inch* of space. A rectangular solid 2 in. wide, $\frac{1}{2}$ in. high, and 1 in. long also takes up 1 cubic inch of space. How do you know this is true?

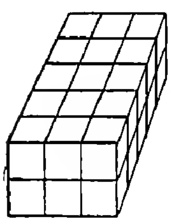
3. A cube 1 yd. long, 1 yd. wide, and 1 yd. high is a 1-yd. cube. It takes up 1 *cubic yard* of space. Write the dimensions of two other rectangular solids that take up 1 cubic yard of space.

Every rectangular solid occupies space. The amount of space that a solid occupies is called its *volume.*

A hollow or empty solid can hold a certain amount of air, of liquid, or of other materials. The amount of anything it can hold is called its *capacity.*

The volume or the capacity of any rectangular solid is measured in cubic inches, cubic feet, or cubic yards.

The picture below shows a rectangular solid made up of 1-in. cubes. The solid is 3 in. wide, 5 in. long, and 2 in. high. You may write these dimensions 3″ x 5″ x 2″.



4. Each layer of the solid has 3 rows of cubes with 5 cubes in each row. There are 3×5, or __ cubes in each layer.

5. There are __ layers of cubes.

6. There are $2 \times$ __, or __ cubes in the rectangular solid.

When you find the number of cubes in the solid, you really find its volume. Since there are thirty 1-in. cubes in the solid, its volume is 30 cubic inches.

When you found the volume of the solid above, you first multiplied 5 by 3 and then multiplied the answer by 2. *You multiplied the solid's three dimensions.* To find the volume of any rectangular solid, multiply its three dimensions. The answer means cubic inches if all dimensions are in inches. It means cubic feet if all dimensions are in feet. It means cubic yards if all dimensions are in yards.

7. What are the three dimensions of the rectangular solid shown in the picture on page 382? Multiply them. Your answer is __. How do you know that this answer means cubic inches?

8. If you rearranged the cubes into another solid 5″ wide, 6″ long, and 1″ high, would the volume of the second solid be different from the volume of the first one? How do you know? How would the second solid be different from the first one?

9. Write the inside dimensions of a box just big enough to hold the pile of cubes as they are shown in the picture on page 382.

10. The capacity of this box is 30 cubic inches. How do you know that this is true?

11. You can find the capacity of this box by multiplying its three inside dimensions. Do this. The capacity of the box is __.

12. Why is it important to use *inside* dimensions when you are finding the capacity of a box?

13. If the pile of cubes were rearranged as suggested in Problem 8, its volume would be the same as the capacity of the box you have been thinking about. Would the pile fit into the box? Why or why not?

14. The volume of a 5-inch cube is $5 \times 5 \times 5$, or __ cubic inches. Why is 5 used three times?

15. Find the capacity of a large box of which each inside dimension is 9 ft. How do you know that your answer means cubic feet?

16. How many cubic feet of earth must be removed to make a basement 16′ wide, 20′ long, and 8′ deep?

Using a Formula to Find Volumes

1. A rectangular prism is 6 ft. long, $4\frac{1}{2}$ ft. wide, and 3 ft. high. Study Example A and the work below to learn how to use a formula to find its volume.

Read this formula *Volume equals length times width times altitude.* The word "altitude" means "height."

When the formula is rewritten, you use 6 for l, $4\frac{1}{2}$ for w, and 3 for a because you know that the length is 6′, the width is $4\frac{1}{2}$′, and the altitude is 3′. $6 \times 4\frac{1}{2} \times 3 =$ __. 81 means cubic feet because all dimensions are in feet.

A
$V = lwa$
$V = 6 \times 4\frac{1}{2} \times 3$
$V = 81$, or
81 cubic feet

2. Use the formula to find the capacity of a box 15″ long, 9″ wide, and 12″ high on the inside. Example B shows how this is done.

What is used for l when the formula is rewritten? What is used for w? What is used for a? What do you do next? Is the 1620 correct?

The capacity of the box is 1620 __.

B
$V = lwa$
$V = 15 \times 9 \times 12$
$V = 1620$, or
1620 cubic inches

3. How many cubic yards of earth must be removed in digging a basement 39′ long, 27′ wide, and 6′ deep? Example C shows one way to find the answer.

Since the answer should be in cubic yards, first change each dimension to yards. In Example C how do you get the 13? The 9? The 2?

When you multiply to find the volume of the dirt removed, why do you use 13, 9, and 2 instead of 39, 27, and 6? Is 234 cubic yards the correct answer?

C
$V = lwa$
$V = 13 \times 9 \times 2$
$V = 234$, or
234 cubic yards

4. Another way to solve Problem 3 is first to multiply the 39, the 27, and the 6. When you do this, the answer is 6318 cubic ___. To change this answer to cubic yards, divide 6318 by 27. You do this because there are 27 cubic feet in 1 cubic yard. $6318 \div 27 =$ ___. Is your answer the same as the answer for Example C?

5. The work below shows a short cut you can use to solve Problem 3. Study this work and be ready to explain why the problem can be solved in this way.

$$\boxed{\frac{39 \times \overset{1}{\cancel{27}} \times 6}{\underset{1}{\cancel{27}}} = 234}$$

6. There is an easy way to remember the number of cubic feet in a cubic yard. Think of a 1-yd. cube as a cube 3 ft. long, 3 ft. wide, and 3 ft. high. Why can you do this? Why will $3 \times 3 \times 3$ give you the number of cubic feet in a cubic yard?

7. How do you know that a 1′ cube is also a 12″ cube? How can you show that 1 cubic foot is equal to 1728 cubic inches?

You will find it convenient to remember the facts given below. *Cu.* is the abbreviation for "cubic."

1728 cu. in. = 1 cu. ft. 27 cu. ft. = 1 cu. yd.

If you need help with Problems 8, 9, and 10, study Self-Help Examples D, E, and F on page 386.

8. A haymow is 70 ft. long and 30 ft. wide. It is filled with hay to a height of 10 ft. Since 1 T. of hay takes up 512 cu. ft. of space, how many tons of hay are in the mow? Give your answer to the nearest ton.

In Problem 8 the height of the haymow is not given. Why is it unnecessary to know this height?

9. A piece of lawn 40′ by 70′ is to be covered with topsoil to a depth of 3″. How many cubic feet of topsoil will be needed?

Why is $\frac{1}{4}$ used for a in Problem 9? If you used 3″ for a, what would you use for l and w? Why? What would you do after you had multiplied the dimensions?

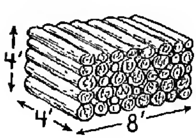
10. A driveway with an area of 1215 sq. ft. is to be covered with a layer of gravel 4″ deep. How many cubic yards of gravel will be needed?

In Problem 10 how do you know that lw = 1215? Why is $\frac{1}{3}$ used for a? How do you get 15 cu. yd.?

D	E	F
$V = lwa$ $V = 70 \times 30 \times 10$ $V = 21{,}000$, or 21,000 cu. ft.	$V = lwa$ $V = \overset{10}{\cancel{40}} \times 70 \times \frac{1}{\underset{1}{\cancel{4}}}$ $V = 700$, or 700 cu. ft.	$V = lwa$ $lw = 1215$ $V = \overset{405}{\cancel{1215}} \times \frac{1}{\underset{1}{\cancel{3}}}$ $V = 405$, or 405 cu. ft.
$21000 \div 512 = 41\frac{8}{512}$, or about 41 T.		405 cu. ft. = 15 cu. yd.

11. Mr. Warren's garden is 80 ft. long and 30 ft. wide. How many cubic feet of fertilizer will he use to cover the garden to a depth of $\frac{1}{2}$ in.?

12. Mr. Boyd cut wood and stacked it into a pile that was 8 ft. wide, 4 ft. high, and 24 ft. long. How many cubic feet of wood were in Mr. Boyd's wood pile?



13. The picture at the left shows the dimensions of 1 *cord* of wood. How many cubic feet are there in 1 cord? Mr. Boyd had ___ cords of wood.

14. A rectangular vegetable bin is 7 ft. long, 6 ft. wide, and 5 ft. high on the inside. Allowing $1\frac{1}{4}$ cu. ft. for 1 bu., find its capacity in bushels.

15. In making an addition to his home, Mr. Harvey had a cellar dug that was $8' \times 10' \times 12\frac{1}{2}'$. How many cubic feet of earth were removed?

16. This picture shows a box containing an Excello Shoe Polishing Outfit. How many such outfits can be shipped in a packing box with inside dimensions of $12'' \times 16'' \times 28''$?

17. A farm electric plant is 3 ft. long, 18 in. wide, and 35 in. high. What are the inside dimensions of the smallest box that it can be shipped in? The capacity of the box will be __ cu. in.

18. Jim's aquarium is 16 in. long, 9 in. wide, and 12 in. high on the inside. Jim fills it to within 2 in. of the top. Allowing 231 cu. in. to each gallon, find about how many gallons of water Jim uses.

19. The inside dimensions of Helen's aquarium are 17″ long, 8″ wide, and 10″ high. She keeps 4 gal. of water in it. She keeps it filled to about what depth?

Find the volume of each rectangular solid whose dimensions are given below. Be sure that all three dimensions for each solid are in the same unit before you multiply.

20. 2 yd. x 3 yd. x $1\frac{1}{2}$ yd.
21. 12.5-ft. cube
22. 8 ft. by 10 ft. by 9 in.
23. 2 ft. by 2 yd. by 6 in.
24. $1' \times 2\frac{3}{4}' \times \frac{3}{4}'$
25. $3.4'' \times 7.5'' \times 1.8''$
26. $3'' \times 4.5' \times 6''$
27. $16' \times 16' \times 16'$

Comparing Prices

1. Study Pictures 1 and 2 on the next page. In Picture 2 how did Marie get $4\frac{1}{6}$¢? How did she get $2\frac{1}{2}$¢? What did she mean when she said that $2\frac{1}{2}$ and $4\frac{1}{6}$ are awkward numbers to compare?

2. In Picture 3 why did Joan use $1 instead of 75¢ or some other amount? How did she get the 24 oz.? The 40 oz.? How did she get the fraction $\frac{3}{5}$?

3. Joan could have said that she got $1\frac{2}{3}$ times as much for her money as Marie did. How is $1\frac{2}{3}$ found?

Read Picture 4 and the list of prices below. The girls made this list at the store and found ways to compare the prices of these groceries.

4. Do 3 small cans of baking powder hold the same amount as 1 large can? Is it cheaper to buy 1 large can instead of 3 small ones? Why? Try to think of another way to show which is cheaper.

5. If you buy the 7-oz. packages of crackers, you can buy __ oz. for $1.70. If you buy 1-lb. packages, you can buy __ oz. for $1.70. Why is it convenient to use $1.70 instead of $1 or some other amount? Make at least one statement that compares the two ways of buying crackers.

Baking powder
4 oz. can for 9¢
12 oz. can for 26¢

Crackers
7 oz. package for 10¢
1 lb. package for 17¢

Dry cereal
11 oz. package for 10¢
18 oz. package for 15¢

Vegetable juice
1 pt. 2 fl. oz. can for 14¢
1 qt. 14 fl. oz. can for 29¢

6. One way to compare the prices on the dry cereal is to think: "In the 11-oz. package it costs $\frac{10}{11}$¢ per ounce. In the 18-oz. package it costs $\frac{5}{6}$¢ per ounce." How are these two fractions found?

7. Next think: "These two prices equal prices of $\frac{60}{66}$¢ and $\frac{55}{66}$¢ per ounce." Why do you change $\frac{10}{11}$ and $\frac{5}{6}$ to $\frac{60}{66}$ and $\frac{55}{66}$? Which way of buying dry cereal is the cheaper?

8. "Fl. oz." on the vegetable juice cans means "fluid ounce." There are 16 fluid ounces in 1 pint. The small can of juice holds __ fluid ounces. How many fluid ounces does the large can hold?

9. Read the following statement: A person who buys 1 large can of vegetable juice instead of 2 small cans gets 10 fl. oz. of juice for only a cent. Is the statement correct? Is this a bargain? Why?

What must I find? Add? Multiply? Shall I subtract? Divide? Why? What numbers shall I use?

Problem Test 7

1. A manufacturing company earned a net amount of \$86,622,752 during its best year. Of this amount \$60,305,204 was paid to the owners of the company, and the remaining amount was kept for expansion of the business. How much was kept for expansion? *(4)*

2. During one week the following number of persons visited the City Museum: Sunday, 1298; Monday, 1308; Tuesday, 342; Wednesday, 784; Thursday, 683; Friday, 106; Saturday, 1380. Find the total number for the week. *(4)*

3. Mr. Adams, who owns several small coal mines, recently sold Mine No. 7 for \$1200. He received \$300 of the selling price in cash and a note for the remaining amount. What per cent of the selling price did he receive in cash? *(4)*

4. Albert Anderson borrowed \$2500 from his grandmother to finish paying for his farm. He agreed to pay interest each six months at the rate of 4% per year. How much interest should he have paid his grandmother at the end of the first six months? *(4)*

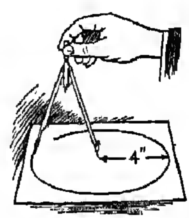
5. In making an addition to his home, Mr. Jones had a cellar dug that was $6' \times 10\frac{1}{2}' \times 8'$. How many cubic feet of earth were removed? *(4)*

6. Mr. Hart has \$3500 of his savings invested at $4\frac{1}{2}\%$ interest. How much interest should he receive each year from this investment? *(5)*

7. Desks are being bought for the new Clay School. The law requires that in every room there must be at least 300 cu. ft. of air space for each pupil. What is the largest number of desks that should be put into a room 25 ft. by 32 ft. by 12 ft.? (5)

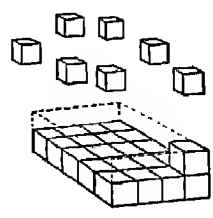
8. A dairyman's record for one of his cows for the month of February showed the following weekly totals for morning milkings: 94.4 lb., 117.3 lb., 107.6 lb., and 125.2 lb. Weekly totals for evening milkings were 84.5 lb., 96.0 lb., 89.6 lb., 85.6 lb. The records showed that this cow gave how many pounds of milk during the month of February? (5)

9. The picture at the right shows a circle being drawn. How long a line is being drawn? (6)



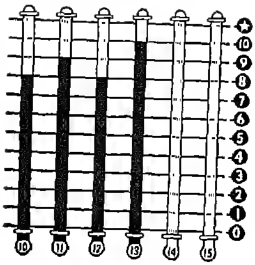
10. Ruth is planning a rectangular flower and vegetable garden 45 ft. by 60 ft. To help her figure the size of plots for vegetables and flowers, she is making a scale drawing of the garden. She is using the scale 1″ = 10′. What should be the length and width of her drawing? (6)

11. When all the blocks shown in the picture at the right have been placed, what per cent of the total volume will still be missing? (7)



Standards for Problem Test 7

Poor	Fair	Average	Good	Excellent
0–9	10–17	18–33	34–43	44–54



Self-Testing Drill 14

You will have exactly *20 minutes* for this drill. If you finish before the time is up, try "A Side-Trip in Mathematics" on page 393.

Example 20 is wrong if any part is wrong.

1.
$$\begin{array}{r} 59 \\ 89 \\ 58 \\ 69 \\ 7 \\ \underline{79} \end{array}$$

2.
$$\begin{array}{r} 7389 \\ 644 \\ 9588 \\ 977 \\ 898 \\ \underline{8656} \end{array}$$

3. Subtract:
$$\begin{array}{r} 114.7299 \\ \underline{56.7684} \end{array}$$

4. Subtract:
$$\begin{array}{r} 17863123 \\ \underline{9376429} \end{array}$$

5. $4\frac{1}{3}+2\frac{7}{12}+1\frac{5}{6}=$

6. $8\frac{1}{6}\times 9=$

7. $\frac{4}{5}\div 6=$

8. Multiply:
$$\begin{array}{r} 3579 \\ \underline{709} \end{array}$$

9. Subtract:
$$\begin{array}{r} 62\frac{1}{6} \\ \underline{39\frac{3}{8}} \end{array}$$

10. Multiply:
$$\begin{array}{r} \text{2 qt. 1 pt.} \\ \underline{8} \end{array}$$

11. Find the interest on \$500 at $4\frac{1}{2}\%$ for 2 years.

12. Divide 7 gal. 2 qt. by 6.

13. $55\div 76.8=$

14. A 15% discount is allowed on a bill of \$8896. Find the amount of the discount.

15. A parallelogram has a base of $4\frac{1}{2}''$ and a height of $1\frac{1}{4}''$. Find its area.

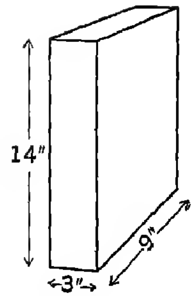
16. To the nearest thousandth, what is the answer for the following example: $358.25\div 356$?

17. What per cent of 336 is 42?

18. Find the volume of the rectangular solid shown at the right.

19. Find the interest on a loan of \$500 for 3 years at 6%.

20. Change to simplest form:
(*a*) 2 bu. 14 pk. (*b*) 1 T. 4500 lb.
(*c*) 3 gal. 8 qt.



Standards for Self-Testing Drill 14

Number Correct	0	1–4	5–6	7	8	9	10–11	12	13	14–15	16–19	20
Rating	0	1	2	3	4	5	6	7	8	9	10	★

A Side-Trip in Mathematics

Example A shows an easy way to change 2′ 7″ to inches.

A
2′7″
4
31, or
31″

1. First double the number of feet. What does 2×2 equal? Where do you write the 4? How do you get the 31? 2′ 7″ = __″.

2. Now change 2′ 7″ to inches in the usual way to prove that 31″ is the correct answer.

3. In Example B, 19′ 11″ is changed to inches. What number do you get when you double 19? Where do you write the 3? The 8?

B
19′11″
3 8
23 9, or
239″

4. Add 11 and 8. The answer is __. Write 9 and carry 1. 1+3+19 = __.

5. Prove that 19′ 11″ = 239″.

6. Use this method to change each measurement below to inches. Prove each answer.

7′ 2″ 11′ 9″ 27′ 11″ 9′ 10″ 36′ 11″

Problems for Good Thinkers

1. Which has the greater area, a square floor 20′ on a side or a circular floor 20′ in diameter? How much greater is it?

2. Which has the greater area, a square floor 5′ on a side or a circular floor with a radius of $2\frac{1}{2}$′? How much greater is it?

3. The area of a circle is always a certain per cent of the area of a square whose side equals the diameter of the circle. What is this per cent?

4. Which will require the longer border, a square flower bed 10′ on a side or a circular flower bed 10′ in diameter? How much longer will this border be?

5. Which will require the longer border, a square flower bed 7′ on a side or a circular flower bed $3\frac{1}{2}$′ in radius? How much longer will this border be?

6. The circumference of a circle is always a certain per cent of the perimeter of a square whose side equals the diameter of the circle. What is this per cent?

7. Which is longer, the inside fence or the outside fence of a circular race track? Explain your answer.

Remember that the inside fence is the one nearer the center of the circle. Draw a diagram if you need to.

8. How could you find the area of the race track?

9. Mr. Young's corncrib rests on a concrete foundation wall 8 in. thick. On the outside the foundation is a square 30 ft. on a side. On the inside the foundation is a square __ ft. on a side.

You can make Problem 9 easier by drawing a diagram.

Without Pencil

	A	B	C	D	E	F
1.	Add: $\frac{1}{12}$ $1\frac{5}{6}$	Interest on \$20 at 2% for 6 mo. is \$------.	$99\overline{)793}$	175% of 400 is ------.	Perimeter of a rectangle, 10′ by 15′ is -----.	10×5.5
2.	5 lb. 8 oz. 4 lb. 15 oz. 7 lb. 9 oz.	$\frac{54}{12}$ in simplest form is ------.	Volume of a 4-ft. cube is ------.	Subtract: $10\frac{2}{3}$ 9	90° are what fraction of a circle?	.2 is what fraction of .4?
3.	3.2% = what decimal?	7′ 50″ in simplest form is ------.	$2\frac{1}{2} \times \frac{3}{4}$	15 is ----% of 75.	Find the average: 4, 5, 0, 6, 7, 8.	$4\overline{).4264}$
4.	Multiply: 342 20	$39 \div 100$	Find the sum of 25, 4, 9, and 30.	.785 = what per cent?	$1\frac{1}{4} \div \frac{1}{16}$	40 is -----% of 200.

Learning through Practice

1. $3\frac{3}{4}\%$ of \$1290 =
2. $15.4 \div 3.08 =$
3. 275% of 600 =
4. $.05 \times .34 =$
5. _% of 1056 is 528.
6. \$714.51 − \$168.53 =
7. $51.34 \div 68 =$
8. $\frac{2}{5}\%$ of \$80 =
9. $16\frac{2}{3}\%$ of \$627 =
10. $86 \times 8709 =$
11. 82 is _% of 164.
12. $83\frac{1}{3}\%$ of \$369 =

Extra Practice for Those Who Need It

13. $\frac{1}{10}\%$ of \$100 =
14. $1053.75 \div .125 =$
15. $33\frac{1}{3}\%$ of \$627 =
16. \$2.46 is _% of \$8.20.
17. $20\frac{1}{3} + 13\frac{3}{4} + 6\frac{3}{8} =$
18. 156% of 892 =
19. $8 \times .006 =$
20. $9112.16 - 4292.47 =$
21. $.93 \times 36 =$
22. $21\frac{1}{12} - 20\frac{3}{4} =$

Think before You Answer

1. Can a triangle whose sides are all equal be a right triangle?

2. Can a right triangle be a scalene triangle? Can a right triangle be an isosceles triangle?

3. In a certain kind of triangle one side is the height. What kind of triangle is it?

4. Can a trapezoid have two right angles? Can it have more than two right angles? Can it have only one right angle?

5. In a parallelogram that is not a rectangle how many angles are acute angles?

6. Is there any figure with four sides that is neither a parallelogram nor a trapezoid? If so, be prepared to draw such a figure.

7. How may you use your protractor to help you draw a rectangle?

8. A drawing of an object is made to the scale 1 in. $=\frac{1}{2}$ in. Is the drawing larger than or smaller than the object? Explain your answer.

9. Why is the scale 1 in. $=\frac{1}{2}$ ft. not a good one to use in drawing on your paper a diagram of a room 24 ft. by 36 ft.? What would be a good scale to use?

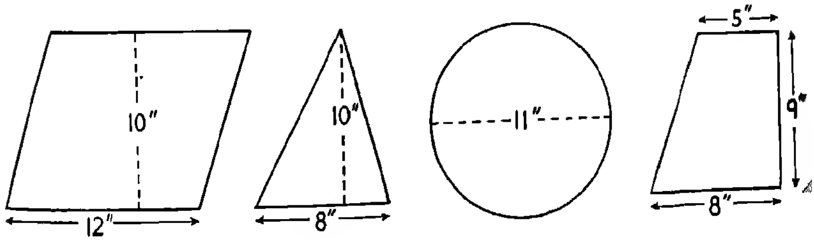
10. What kind of parallelogram can be divided into two equal right triangles?

11. Can the parallel sides of a trapezoid be equal in length? Explain your answer.

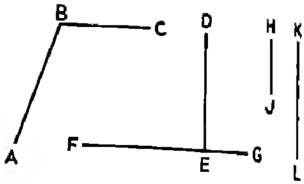
12. Can the opposite sides of a parallelogram be unequal in length? Explain your answer.

Checking Up

1. Write *70 billion 40 million 60* in figures.
2. Write *185 millionths* as a decimal fraction.
3. What kind of angle contains less than 90°?
4. What kinds of angle contain more than 90°?
5. How many degrees are there in $\frac{1}{10}$ of a circle?
6. The height and base of a parallelogram, triangle, or trapezoid always form an angle of __°.
7. Find the interest on \$125 at 5% for 1 yr. 8 mo.
8. A discount of 88¢ on \$2.64 is a discount of __%.
9. Using the scale $\frac{1}{2}$ in. = 10 mi., how long a line should you draw to represent 100 mi.?
10. Should you use $A=\frac{1}{2}bh$, $A=\pi r^2$, or $V=lwa$ to find the volume of a rectangular prism?
11. What does the word *net* mean when used before such words as *income, amount, cost,* and *bill?*
12. Write $3\frac{1}{2}\%$ as a decimal fraction with three places. As a decimal fraction with two places.
13. The triangle below is what kind of triangle?
14. Find the area of the triangle below.
15. Find the area of the parallelogram below.
16. Find the area of the circle below.
17. Find the area of the trapezoid below.
18. What is the radius of the circle below?
19. Find the circumference of the circle below.



20. Which lines in the picture at the right are perpendicular to line *FG?* Which line is parallel to line *FG?*



21. How many lines are parallel to line *HJ?* Write the names of these lines.

22. $2\frac{2}{3}$ times a number is __% of the number.

23. Is 885% of 1 more than or less than 8.8?

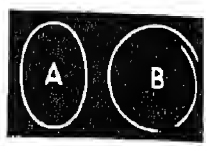
24. When is a line perpendicular to another line?

25. When are two lines parallel?

26. Write the formulas for finding the area and for finding the circumference of a circle.

27. What is the smallest number of whole degrees that must be added to a 75° angle to make it obtuse?

28. How do you know that Diagram A at the right is not a circle?



29. How do you know that Diagram B is not a circle?

30. If you were to divide the circumference of any circle by its diameter, approximately what number should you get for your answer?

31. The parallel sides of a trapezoid are its __.

32. The dimensions of a parallelogram are its __ and its __.

33. Find the volume of a 15-in. cube.

Find the volume of each rectangular solid below.

34. $3\frac{1}{3}$ ft. x $2\frac{1}{2}$ ft. x $1\frac{1}{4}$ ft.

35. $2\frac{1}{3}''$ x 6″ x 8″

36. 6.5″ x 4.3″ x 2.8″

37. 25′ x 38′ x $6\frac{1}{2}'$

38. 3 yd. x 8 yd. x 1.5 ft.

39. 5 yd. x 2 ft. x 9 in.

CHAPTER 8

Making Sure You Remember

Common Fractions and Mixed Numbers

If you have forgotten anything reviewed below or on the following pages, the page number at the end of each sentence or problem will tell you where to find help.

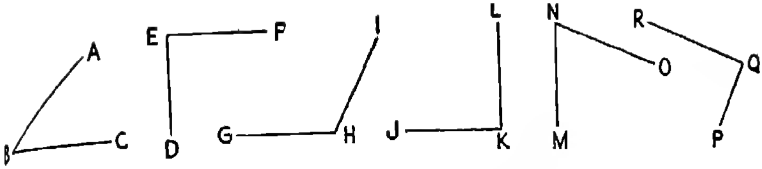
1. Write a proper fraction, an improper fraction, and a mixed number. *(12)*
2. In the fraction $\frac{9}{10}$ the numerator is __ and the denominator is __. *(11)*
3. A mixed number is made up of a __ and a __. *(12)*
4. Change the following numbers to simplest form: $\frac{12}{16}$, $\frac{16}{6}$, $5\frac{4}{8}$, $\frac{11}{2}$, $\frac{24}{4}$, $4\frac{8}{6}$. *(434-435)*
5. $\frac{1}{4}$ of 116 is __. *(28, 448)*
6. 55 is what fraction of 165? *(28)*
7. 47 is $\frac{1}{6}$ of __. *(29)*
8. $\frac{4}{5}$ of $\frac{1}{3}$ is what common fraction? *(449)*
9. Is $\frac{1}{2}$ or $\frac{1}{3}$ the approximate value of $\frac{289}{605}$? *(90)*

Decimal Fractions

1. 3.14 is read *three* __ *fourteen* __.
2. Write as decimals: $\frac{27}{100}$, $\frac{3}{4}$, $5\frac{1}{2}$, $\frac{121}{10000}$. (*104*)
3. Write as common fractions: .007, .9999. (*103*)
4. In 5.01257 there are __ decimal places. (*103*)
5. Are .30, .22, .12, and .35 of a number all of the number? How can you tell? (*108-110*)
6. Write $16\frac{1}{4}\%$ with a decimal fraction to two decimal places. To four places. (*222, 224-225*)
7. To the nearest hundredth, $8.457\frac{12}{17}$ is __. To the nearest thousandth, $8.457\frac{12}{17}$ is __. (*222, 224-225*)
8. To change $\frac{5}{6}$ to a decimal, divide __ by __. (*104*)
9. \$6.80 is what decimal fraction of \$8.50? (*36-37*)
10. \$1.20 is .75 of what amount? (*37*)

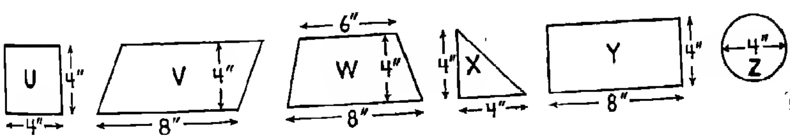
Per Cents

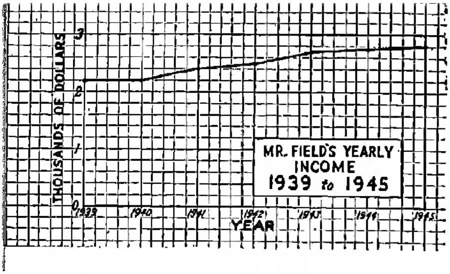
1. 5% is read *five* __. It means 5__. (*106*)
2. Give the common fraction equivalents for 25%, $87\frac{1}{2}\%$, 10%, $33\frac{1}{3}\%$, and $16\frac{2}{3}\%$. (*112, 151*)
3. Write as decimals: 40%, $1\frac{1}{4}\%$, 113.9%. (*111, 152*)
4. Write the following as per cents: $\frac{3}{4}$, .8, 5, .127, $\frac{1}{25}$, .005, 1.27. (*111, 112, 153, 170*)
5. All of anything is __% of it. (*108-110*)
6. 400% of 12 is __ times 12, or __. (*170*)
7. $22\frac{1}{2}\%$ of 48 is __ × 48, or __. (*154*)
8. Write $\frac{1}{4}\%$ as a decimal. (*170*)
9. \$25 increased by 20% of itself equals __. (*182-183*)
10. __% of 125 is 15. (*218*)
11. 16 is what per cent of 48? (*223*)
12. In round numbers 89 is __% of 215. (*223*)

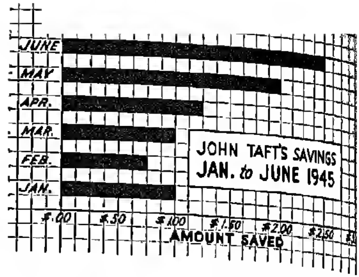


Lines, Angles, and Figures

1. Lines JK and LK above are ___ to each other. (296)
2. Lines NO and RQ are ___ to each other. (296)
3. Which three angles are 90° angles? (304)
4. Angle GHI is an ___ angle. Its vertex is labeled ___. Its sides are ___ and ___. (301, 303)
5. Angles ___ and ___ are acute angles. (301)
6. A straight angle is an angle of ___°. (301, 304)
7. Figure U below is a ___. Its dimensions are ___″ by ___″. Its perimeter is ___″. (40, 41, 42)
8. Which two parallelograms below have the same area? Find the area. (309, 358)
9. Figure W is a ___. Its bases are ___″ and ___″. Its height is ___″. (311, 364)
10. What is the area of Figure W? (366)
11. Which two figures below are rectangles? (40)
12. Why can you say that Figure X is a right triangle? An isosceles triangle? (313, 314)
13. What is the area of Figure X? (360-362)
14. Figure Z is a ___. (324-325)
15. The diameter of Figure Z is ___″. (326)
16. The radius of Figure Z is ___″. (325)
17. The circumference of Figure Z is ___″. (328-330)
18. What is the area of Figure Z? (368-370)
19. Figure W has ___ obtuse angles. (301)
20. Figure V has ___ acute angles. (301)
21. Figure X is what fraction of Figure U? (361)

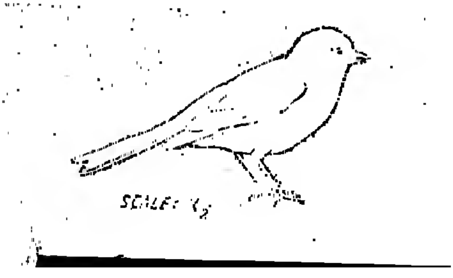


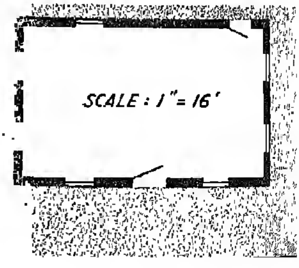




Graphs and Scale Drawings

1. The graph above at the left is a __ graph. (64)
2. What is the title of this graph? (53)
3. The 0, 1, 2, and 3 on the vertical scale represent __ of dollars. (64)
4. Mr. Field's income increased from $__ in 1939 to $__ in 1945. (64-66)
5. Is the graph above at the right a vertical bar graph or a horizontal bar graph? (53)
6. The scale along the heavy horizontal line represents __. It runs from $.00 to $__. (52)
7. John saved the most money in __. (52-54)
8. He saved the least money in __. (52-54)
9. What scale was used in the picture of the bird below? (339)
10. Was the actual bird $\frac{1}{2}$ as large or twice as large as the bird in the picture? (339)
11. On the drawing below at the right, what is meant by *Scale: 1″ = 16′*? (339)
12. The inside dimensions of the living room in the scale drawing below are $1\frac{1}{2}''$ by $\frac{7}{8}''$. What are the actual dimensions of the room? (339)





FOSTER COAL COMPANY

1440 ASHLAND AVE. • HANNIBAL, MISSOURI

orge C. Cooper
74 Loomis Street
nnibal, Missouri

June 3, 1946

TERMS: 2% 10 DAYS

une 3	5 Tons Pocahontas Mine Run @12.97	$ 64.85
	1 Load kindling wood	$ 5.00
		$ 69.85

Bills and Accounts

1. On the bill shown above what is the meaning of "2% 10 days"? *(160)*
2. What is the gross amount of this bill? What is the net amount? *(158)*
3. Money paid for the use of money is __. *(197)*
4. Money put into a savings account is called a __. Money taken out is called a __. *(196, 197)*
5. The formula for finding interest is __. What does each of the letters represent? *(206)*
6. Interest that is earned by interest is called __ interest. *(201)*
7. The amount of money on which interest is paid is called the __. *(200)*
8. When a man is paid a per cent of his sales, his pay is called __. *(118)*
9. In accounts, money received is called a __. Money paid out is called an __. *(244)*
10. Give three ways in which money may be sent safely by mail. *(252, 254, 256)*
11. How should you endorse a check? *(257-258)*
12. What is a sales slip? How is it different from a monthly statement? *(268-270)*
13. How should a bill be receipted? *(270)*

Review of Whole Numbers

If you need help with the addition examples below, study pages 422-424.

1.			83		31	$717
	597	$ .63	98	85	212	489
	248	9.90	20	688	733	475
	766	4.64	48	149	50	708
	955	.62	56	10	879	265
	724	6.57	35	9	5	549

2.		301	$ .56	$824		243
	90	895	4.59	106	907	215
	309	204	7.87	336	422	748
	756	992	.74	184	103	669
	165	237	2.18	205	461	838
	26	386	7.27	378	98	409

If you need help with the subtraction examples below, study pages 424-426.

3.	8004	$261.50	$357.20	47945	92658	$740.02
	3745	5.73	7.40	6498	65369	476.23

4.	164006	$4312.67	663024	$63345.03	710055
	8545	937.78	86147	8469.35	277037

If you need help with the multiplication examples below and on the next page, study pages 427-429.

5.	546	$3.25	3576	4297	$80.61	17908
	6	74	38	15	405	97

6.	849	5327	1209	523	40618	$69.87
	638	901	123	568	3109	47

7\.

734	2514	6908	9345	3579	20746
265	47	815	209	5130	68

Divide to the nearest hundredth if necessary. If you need help, study pages 430-433 and page 460.

8\. $5\overline{)\$375.20}$ $\quad 9\overline{)35844}$ $\quad 80\overline{)48089}$ $\quad 97\overline{)44329}$

9\. $25\overline{)16770}$ $\quad 36\overline{)132840}$ $\quad 28\overline{)16744}$ $\quad 17\overline{)\$48.60}$

10\. $14\overline{)\$1269.80}$ $\quad 19\overline{)19093}$ $\quad 546\overline{)69897}$ $\quad 705\overline{)693015}$

11\. $238\overline{)484806}$ $\quad 270\overline{)162139}$ $\quad 168\overline{)9925}$ $\quad 194\overline{)112535}$

Review of Measures

If you have forgotten the measures used below, review pages 20, 44, 95-97, 385, 464-467, and 480.

1. 1440 sq. in. = __ sq. ft., or __ sq. yd.
2. 6400 sq. rd. = __ A., or __ sq. mi.
3. 3 cu. yd. = __ cu. ft.
4. 5 kilograms = about __ lb.
5. 25 long tons = __ short tons
6. 3 mi. 425 ft. = 2 mi. __ ft.
7. 288 in. = __ yd.
8. 17 pk. = __ bu.
9. 6 T. = __ lb.
10. 4 da. = __ hr.

Change to simplest form:

11. 7 ft. 16 in.
12. 5 yd. 47 in.
13. 10 rd. 38 ft.
14. 2 yr. 490 da.
15. 18 pk. 9 qt.
16. 5 qt. 12 pt.
17. Add:

    6 gal. 3 qt.
    5 gal. 2 qt.

18. Subtract:

    26 lb. 5 oz.
    17 lb. 12 oz.

19. Multiply:

    9 yd. 2 ft.
    7

20. 12 bu. 2 pk. ÷ 5
21. 45 min. 23 sec. ÷ 7

Review of Fractions and Mixed Numbers

If you need help with the addition examples below, study pages 437-441.

1.	$\frac{1}{2}$	$\frac{3}{4}$	$3\frac{1}{16}$	4	$\frac{1}{2}$	$6\frac{11}{12}$	$\frac{5}{12}$
	$\frac{1}{2}$	$2\frac{3}{4}$	$1\frac{5}{16}$	$\frac{2}{3}$	$\frac{3}{16}$	5	$3\frac{1}{3}$

2.	$\frac{11}{12}$	7	$\frac{3}{5}$	$16\frac{5}{6}$	$\frac{1}{8}$	$3\frac{1}{2}$	$10\frac{11}{12}$
	$\frac{2}{3}$	$\frac{1}{2}$	$\frac{1}{4}$	4	$\frac{3}{4}$	$\frac{5}{6}$	$2\frac{5}{8}$
	$\frac{3}{4}$	$\frac{4}{5}$	9	$\frac{11}{12}$	$\frac{9}{16}$	$8\frac{2}{3}$	$1\frac{1}{4}$

3.	$\frac{5}{12}$	$\frac{3}{10}$	$1\frac{2}{3}$	$7\frac{1}{3}$	$\frac{1}{6}$	$6\frac{1}{5}$	$24\frac{3}{5}$
	$\frac{5}{6}$	14	$\frac{1}{4}$	$\frac{7}{8}$	$\frac{1}{12}$	$3\frac{2}{3}$	$3\frac{1}{10}$
	$\frac{1}{12}$	$8\frac{3}{4}$	$\frac{1}{6}$	$\frac{5}{12}$	$\frac{5}{6}$	$8\frac{1}{5}$	32

4. $4\frac{1}{4}+8\frac{3}{8}$ $\quad$ $\frac{1}{3}+\frac{1}{4}+\frac{1}{12}$ $\quad$ $\frac{1}{3}+\frac{3}{4}+\frac{5}{12}$ $\quad$ $\frac{1}{3}+2\frac{11}{12}+5$

5. $8\frac{3}{4}+2\frac{1}{5}$ $\quad$ $\frac{1}{8}+\frac{1}{3}+\frac{1}{2}$ $\quad$ $\frac{3}{8}+\frac{5}{6}+\frac{1}{6}$ $\quad$ $\frac{2}{3}+\frac{1}{2}+\frac{1}{3}$

If you need help with the subtraction examples below and on the next page, study pages 442-446.

6.	$\frac{3}{5}$	$8\frac{1}{6}$	$\frac{1}{4}$	$6\frac{3}{8}$	$13\frac{2}{3}$	$3\frac{3}{16}$	$5\frac{1}{3}$
	$\frac{2}{5}$	8	$\frac{3}{16}$	$\frac{7}{8}$	$6\frac{5}{8}$	$1\frac{9}{16}$	$\frac{1}{5}$

7.	$1\frac{1}{3}$	$7\frac{1}{2}$	$4\frac{7}{12}$	8	$1\frac{1}{6}$	$3\frac{7}{10}$	$10\frac{5}{16}$
	$\frac{1}{3}$	$\frac{5}{6}$	$2\frac{5}{12}$	$\frac{4}{5}$	$\frac{11}{12}$	$3\frac{1}{4}$	$7\frac{3}{4}$

8.	$13\frac{1}{12}$	$5\frac{1}{6}$	$\frac{4}{5}$	$\frac{2}{5}$	$6\frac{1}{8}$	$1\frac{3}{4}$	16
	$6\frac{5}{6}$	$4\frac{2}{3}$	$\frac{3}{10}$	$\frac{1}{4}$	$2\frac{5}{12}$	$\frac{11}{12}$	$3\frac{7}{8}$

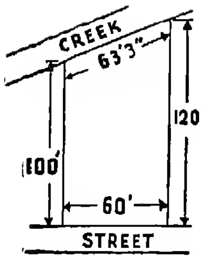
9.	$7\frac{5}{16}-2\frac{13}{16}$	$1\frac{7}{10}-\frac{1}{2}$	$3\frac{3}{4}-2\frac{3}{4}$	$7\frac{1}{3}-7\frac{1}{6}$
10.	$11\frac{3}{5}-4\frac{1}{4}$	$\frac{5}{6}-\frac{1}{2}$	$8\frac{7}{12}-4\frac{1}{4}$	$14\frac{2}{3}-13\frac{7}{8}$

If you need help with the multiplication examples below, study pages 447-450.

	A	B	C	D
11.	$4\frac{1}{5}\times 2\frac{1}{12}$	$\frac{2}{3}\times\frac{3}{5}$	$\frac{5}{6}\times\frac{9}{16}$	$2\frac{1}{12}\times\frac{9}{10}$
12.	$\frac{4}{5}\times\frac{5}{12}$	$3\times\frac{1}{4}$	$\frac{9}{10}\times\frac{5}{12}$	$\frac{5}{6}\times 12$
13.	$8\times 3\frac{1}{2}$	$\frac{1}{12}\times 5$	$1\frac{2}{5}\times\frac{3}{8}$	$12\times\frac{7}{10}$
14.	$\frac{5}{12}\times 8\frac{1}{4}$	$2\frac{1}{4}\times\frac{1}{12}$	$\frac{1}{6}\times 1\frac{1}{5}$	$5\frac{1}{3}\times\frac{3}{8}$
15.	$3\frac{1}{3}\times\frac{1}{10}$	$8\times\frac{1}{16}$	$9\times 3\frac{1}{2}$	$2\frac{1}{12}\times 2\frac{2}{5}$
16.	$\frac{1}{2}\times\frac{1}{5}$	$\frac{1}{16}\times 6$	$3\frac{1}{4}\times 3$	$\frac{9}{10}\times 2\frac{1}{12}$
17.	$9\frac{1}{2}\times 18$	$\frac{15}{16}\times\frac{2}{5}$	$6\times 12\frac{3}{4}$	$2\frac{7}{10}\times 5\frac{5}{6}$

If you need help with the division examples below, study pages 451-454.

18.	$\frac{1}{16}\div\frac{1}{5}$	$3\frac{3}{8}\div 3\frac{9}{10}$	$3\frac{1}{2}\div 8$	$12\div\frac{1}{5}$
19.	$\frac{3}{5}\div 3$	$\frac{7}{10}\div\frac{7}{10}$	$1\frac{4}{5}\div 1\frac{1}{10}$	$\frac{1}{12}\div\frac{5}{6}$
20.	$\frac{3}{4}\div 3\frac{3}{8}$	$16\div 3\frac{1}{5}$	$\frac{9}{16}\div 3\frac{3}{10}$	$6\div 3\frac{1}{3}$
21.	$2\frac{5}{12}\div\frac{1}{12}$	$\frac{3}{8}\div\frac{2}{3}$	$9\frac{9}{10}\div 3\frac{3}{10}$	$1\frac{1}{8}\div\frac{1}{12}$
22.	$\frac{7}{16}\div\frac{3}{4}$	$5\frac{3}{5}\div\frac{7}{10}$	$\frac{7}{10}\div\frac{1}{6}$	$10\div 1\frac{7}{8}$
23.	$5\frac{5}{6}\div 2\frac{1}{12}$	$1\frac{1}{4}\div\frac{5}{6}$	$\frac{5}{6}\div\frac{5}{8}$	$\frac{9}{10}\div 7\frac{1}{2}$
24.	$12\frac{3}{4}\div\frac{3}{5}$	$2\frac{4}{5}\div\frac{7}{10}$	$1\frac{4}{5}\div 2\frac{1}{10}$	$\frac{4}{5}\div 6$



Areas and Volumes

1. This picture shows the plan of a lot that Mr. Brown bought. What is the area of the lot? *(364-367)*

2. A 4-ft. walk was built across the front of Mr. Brown's lot. The walk covered — sq. yd. of surface. *(43-45)*

3. The cellar for the house was dug 6′ deep, 33′ long, and 28′ wide. How many cubic yards of earth had to be removed? *(384-387)*

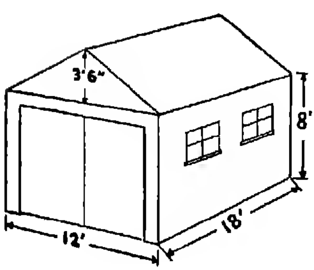
4. When Mr. Brown moved from his old house, he sold his leftover coal to the new owner. The coal bin was 12′ long and 9′ 6″ wide. It was filled with coal to an average depth of 15″. Allowing 35 cu. ft. of coal to the ton, find about how many tons of coal Mr. Brown sold to the new owner. *(384-387)*

Below is a drawing of Mr. Brown's garage, which he plans to paint. To find out how much paint he needs for the outside walls and doors, Mr. Brown figured the area, without deducting the area of the windows.

5. There are — sq. ft. of surface in the triangular part on the front of the garage. *(360-363)*

6. What is the area of the rectangular part of the front of the garage? *(43-45)*

7. What is the area of the entire front? *(16-18)*



8. Find the area of both the front and the rear of the garage, including the doors. *(16-18)*

9. What is the total area of the other sides, including windows? *(43)*

10. Find the total area of all four walls. *(16-18)*

11. One gallon of the paint Mr. Brown plans to use covers about 275 sq. ft. of surface. About how much paint should he buy? *(16-18)*

12. A rectangular field 90 rd. by 72 rd. cost \$125 per acre. What was the total cost? *(43-45)*

13. How many feet of fence would be needed to go all around this field? *(42)*

14. A grain bin has inside dimensions of 10 ft. by 9 ft. by 10 ft. Figuring 1 bu. as $1\frac{1}{4}$ cu. ft., find the capacity of the bin in bushels. *(384-387)*

15. How much fencing is needed to enclose a circular flower bed that has a 4-ft. radius? *(328-331)*

16. What is the area of this flower bed? *(368-371)*

17. At \$2.75 a square yard, find the cost of enough linoleum to cover a kitchen floor 9 ft. square. *(43-45)*

18. The Hadden driveway is a rectangle 10′ by 45′. How many cubic feet of gravel will be needed to cover it to a depth of 6 in.? *(384-387)*

19. A trough on Mr. Little's farm has inside dimensions of 2′ 6″ x 3′ x 10′. How many cubic feet of water will it hold? How many gallons of water will it hold? Use 231 cu. in. as equal to 1 gal. and find your answer to the nearest whole gallon. *(384-387)*

20. Ruth Herman and her brother figured the cost of grass seed for their new lawn, which is a rectangle 40 ft. by 50 ft. Five pounds of the grass seed will plant 1000 sq. ft. of lawn. At 49¢ per pound, how much will enough seed for the lawn cost? *(16, 43-45)*

Review of Decimals

If you need help with the addition examples below, study pages 455-456.

1.		6.81		.8	.283	30.1
		6.30	647.0	5.4	.813	.6
	84.5	2.61	857.5	71.4	.357	7.8
	74.0	3.84	766.1	.9	.907	96.5
	29.9	4.56	850.3	99.8	.568	97.4

If you need help with the subtraction examples below, study page 456.

2.	.93	130.6	834.07	2.958	61.851
	.87	129.7	834.00	2.000	.956
3.	922.0	9134.32	6418.14	83.000	816.765
	221.8	2858.00	418.46	73.635	254.765

If you need help with the multiplication examples below, study pages 456-459.

4.	406	.18	3.06	1.75	.398	206.7
	.009	.16	.27	24	9.64	7.09
5.	.0105	.058	12.5	.0079	.842	164
	8	7.9	3.6	7.8	382	8.75

Divide to the nearest thousandth if necessary. If you need help, study pages 459-462.

6.	$.8\overline{).64}$	$6\overline{).9}$	$34\overline{)15.504}$	$69.01\overline{)5}$	$.23\overline{)43.47}$
7.	$20\overline{)9}$	$.75\overline{)693}$	$7.8\overline{)1.014}$	$.65\overline{)247}$	$90.1\overline{)2.3426}$
8.	$35\overline{).55}$	$2.48\overline{).5}$	$.643\overline{).048}$	$1.5\overline{)54}$	$18.94\overline{)1.2}$

Review of Per Cents

If you need help with the exercises below, review pages 111, 112, 115, 118, 151, 152-153, 154, 170, 172, 176, 218, 223, 227, and 230.

1. Write the following decimals as per cents.

.2 .038 .09 2.4 7.25 .36 1.01

2. Give the fraction and decimal equivalents for:

25% 3% $33\frac{1}{3}\%$ 47% $83\frac{1}{3}\%$ $87\frac{1}{2}\%$ 140%

3. Change the following to per cents.

$\frac{1}{2}$ $\frac{5}{6}$ $\frac{3}{8}$ $1\frac{7}{8}$ $2\frac{1}{4}$ $\frac{5}{8}$ $1\frac{1}{10}$ $\frac{5}{12}$ $\frac{24}{25}$

Find the following.

4. $45 is __% of $1500.
5. 175% of 596 is __.
6. 7 is __% of 350.
7. __% of 16 is 52.
8. .8% of 500 is __.
9. $6\frac{1}{4}\%$ of 56 is __.
10. 237 is __% of 1185.
11. $\frac{3}{4}\%$ of $68 is $__.
12. __% of $25.50 is $7.65.
13. $\frac{1}{4}\%$ of 682 is __.
14. 66 is __% of 275.
15. $83\frac{1}{3}\%$ of 876 is __.
16. 300% of 182 is __.
17. __% of 72 is 63.
18. 180 is __% of 20.
19. 2.9% of 127 is __.
20. $16\frac{2}{3}\%$ of 198 is __.
21. 25% of 2000 is __.

Problems Using Per Cents

1. The Allison family's yearly income is $3000. Their budget divisions are: wage deductions, 10%; savings, 10%; food, 23%; shelter, 20%; clothing, 15%; life insurance, 2%; operating costs, 7%; health, 5%; advancement, 8%. How much should be set aside each month for each budget division? *(115-117)*

2. How much can Mrs. Lane save on a $22.75 dress at a 20% discount? What will be the net price? *(154-156)*

3. At a 5% commission, how much would Mr. Nash earn on a $6750 real estate sale? *(118-120)*

4. Last month Miss Lee earned $211 on total sales of $5275. Find her rate of commission. *(218-220)*

5. Jane Eaton's allowance and earnings totaled $2.40 last week. Her expenditures were: school supplies, 36¢; lunches at school, 80¢; recreation, 40¢; savings, 60¢; miscellaneous, 24¢. Write each of these expenditures as a per cent of Jane's income last week. How can you check your answer by finding the sum of these per cents? *(108-110, 218-220)*

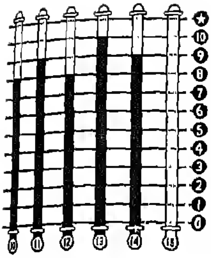
6. At a clearance sale Mr. Dennis bought a $49.50 overcoat for $33. Find the rate of discount. *(232-233)*

7. $276 was left in a savings account from Jan. 1 to June 30. No withdrawals or deposits were made during that time. Interest at $1\frac{1}{2}\%$ a year was added to the account July 1. Find the July 1 balance. *(206-207)*

8. Last year Mr. Olson's salary was $2250. This year it is $2475. His salary this year is —% of his last year's salary. *(227-229)*

9. Mr. Ames put $420 of his savings in the bank and invested the remaining $1330 in bonds. What per cent of his total savings did he deposit in the bank? What per cent did he invest in bonds? *(221)*

10. Mr. Lane borrowed $480. At the end of 2 years he paid back $528, including both principal and interest. Find the rate of interest. *(221)*



Self-Testing Drill 15

This is the last Self-Testing Drill that you will have this year. Try to make your best rating for the year. You will have 20 *minutes* for this drill.

1. Subtract:
139635
57578

2. Find the difference:
10723.1
9349.3

3. Add:
4 hr. 15 min.
2 hr. 40 min.
3 hr. 30 min.

4. $3\frac{2}{3}$
$2\frac{1}{4}$
$7\frac{5}{6}$

5. Multiply:
2 hr. 25 min.
3

6. Three different kinds of angles are *acute*, *right*, and *obtuse*.
(*a*) Which kind is largest?
(*b*) Which kind is smallest?

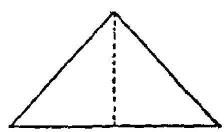
7. $2\frac{1}{4}\times 2\frac{3}{10}=$

8. $947\overline{)582405}$

9. $4\frac{1}{2}\%$ of \$850 =

10. Multiply .386 by .209.

11. The base of the triangle shown at the right is 30 yd. Its height is 15 yd. Find its area.



12. $4.78\overline{)8.4176}$

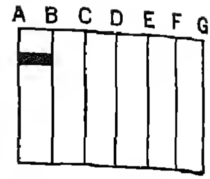
13. Write on your paper the numbers that are missing below.

14. Multiply:
60304
7009

	FRACTION	DECIMAL	PER CENT
a	$\frac{4}{100}$	?	?
b	?	.03	?
c	?	?	150 %

Go on to the next page.

15. The bar shown in the graph at the right extends from A to B. This bar represents 25% of a certain number.



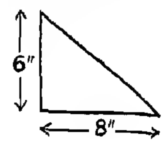
(*a*) A bar on this graph representing 150% of the number would extend from A to ___.

(*b*) A bar representing $33\frac{1}{3}$% of it and starting at A would end between ___ and ___.

(*c*) A bar representing 110% of the number and starting at A would end nearest ___.

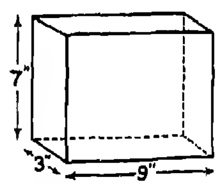
16. How much is the interest on a note for $450 for 3 years 1 month at 4%?

17. Find the area of the triangle shown at the right.



18. (*a*) 1 ft. = ___ in. (*b*) 1 sq. ft. = ___ sq. in.
(*c*) 1 cu. ft. = ___ cu. in.

19. Find the volume of the box shown at the right.



20. Write the formula for finding the area of a circle.

Examples 6, 13, 15, and 18 are wrong if any parts are wrong.

Standards for Self-Testing Drill 15

Number Correct	0	1–3	4–5	6	7	8	9–10	11–12	13	14–15	16–19	20
Rating	0	1	2	3	4	5	6	7	8	9	10	★

Be sure to complete your Progress Chart. Did you do better work on Drill 15 than on Drill 1?

REVIEW TESTS*

These tests review the work that you did last year. They will show you the parts of the Self-Help Practice on pages 422-467 that you should study.

Review Test 1: Addition of Whole Numbers

You will have exactly *8 minutes* to do this test. Your teacher will tell you when to begin.

	A	B	C	D
	84	989	56	888
	46	427	39	975
Row 1	54	505	89	247
	45	953	56	790
	56	756	26	367
	170			3565
	992	9391	1671	5839
Row 2	805	764	374	2831
	81	6442	5629	6886
	893	4780	384	5492
	755	7661	8699	1226

Look at the Standards below. If your work is not "Excellent" or "Good," do Self-Help Tests 1 and 2 on page 422.

Standards for Review Test 1

Poor	Fair	Average	Good	Excellent
0–3	4–5	6	7	8

*To the Teacher: Pupils just beginning seventh-grade work were used for the standardization of these Review Tests. Pupils scoring *Good* or *Excellent* probably need no remedial work. Those scoring *Poor* or *Fair* should have a thorough review. Those scoring *Average* should be assigned remedial work in amounts fitting their needs. The Self-Help Tests and Practice, pages 422-467, provide diagnostic and remedial work.

Review Test 2: Subtraction of Whole Numbers

You will have *7 minutes* for this test. Your teacher will tell you when to begin. Subtract in each example.

	A	B	C	D
Row 1	39969 674	83397 41589	61353 57676	111930 3046
Row 2	158530 73871	203232 85292	116187 46925	199065 77308
Row 3	445661 254916	424833 379187	721977 654658	926472 592483

Standards for Review Test 2

Poor	Fair	Average	Good	Excellent
0–6	7–9	10	11	12

If your work on Review Test 2 is not "Excellent" or "Good," do Self-Help Tests 3, 4, and 5 on page 424 to find out what review you need.

Review Test 3: Multiplication of Whole Numbers

You will have *12 minutes* for this test. Your teacher will tell you when to begin. Multiply in each example.

	A	B	C	D
Row 1	8459 34	73062 43	854 286	7296 680
Row 2	9583 597	7963 6090	2467 1275	8540 7009

Standards for Review Test 3

Poor	Fair	Average	Good	Excellent
0–1	2	3–5	6	7–8

If your work on Review Test 3 is not "Excellent" or "Good," do Self-Help Tests 6, 7, and 8 on page 426.

Review Test 4: Division of Whole Numbers

You will have exactly *15 minutes* to do this test. Your teacher will tell you when to begin.

	A	B	C	D
Row 1	$68\overline{)23991}$	$59\overline{)40120}$	$33\overline{)99264}$	$47\overline{)136430}$
Row 2	$712\overline{)58389}$	$394\overline{)31562}$	$865\overline{)343405}$	$981\overline{)183497}$

Standards for Review Test 4

Poor	Fair	Average	Good	Excellent
0–1	2	3–5	6	7–8

If your work on Review Test 4 is not "Excellent" or "Good," do Self-Help Tests 9 to 13 on page 429.

Review Test 5: Addition of Fractions

You will have exactly *10 minutes* for this test. Be sure that your answers are in simplest form.

	A	B	C	D	E
Row 1	$\frac{2}{5}$ $3\frac{2}{5}$ $\underline{2}$	$\frac{3}{8}$ $\underline{\frac{5}{8}}$	$8\frac{3}{4}$ $\underline{\frac{4}{5}}$	$4\frac{3}{4}$ $\underline{7\frac{7}{10}}$	$\frac{3}{4}$ $\frac{3}{8}$ $\underline{\frac{11}{12}}$

Go on to the next page.

	A	B	C	D	E
Row 2	$\frac{1}{3}$ $5\frac{1}{4}$ $\frac{1}{12}$	$\frac{1}{8}$ $\frac{1}{3}$ $\frac{3}{8}$ $\frac{1}{8}$	$\frac{1}{3}$ $6\frac{4}{5}$ 9 $1\frac{1}{3}$	$\frac{1}{6}$ $\frac{3}{8}$ $\frac{1}{6}$ $\frac{1}{8}$	$2\frac{1}{5}$ $\frac{3}{10}$ $7\frac{1}{2}$

Standards for Review Test 5

Poor	Fair	Average	Good	Excellent
0–2	3–5	6–7	8–9	10

If your work on Review Test 5 is not "Excellent" or "Good," do Self-Help Tests 15 to 18 on pages 436-437.

Review Test 6: Subtraction of Fractions

You will have *10 minutes* for this test. Subtract in each example and change your answers to simplest form.

	A	B	C	D	E	F
Row 1	$\frac{5}{8}$ $\frac{1}{2}$	$\frac{5}{6}$ $\frac{3}{4}$	$9\frac{1}{4}$ 3	$3\frac{5}{6}$ $2\frac{1}{6}$	$7\frac{1}{8}$ $4\frac{5}{6}$	12 $4\frac{4}{5}$
Row 2	$10\frac{2}{3}$ $3\frac{2}{3}$	$8\frac{7}{10}$ 8	$9\frac{7}{16}$ $\frac{11}{16}$	11 $\frac{5}{6}$	$3\frac{1}{4}$ $2\frac{1}{2}$	$12\frac{4}{5}$ $8\frac{1}{3}$

Standards for Review Test 6

Poor	Fair	Average	Good	Excellent
0–4	5–8	9–10	11	12

If your work on Review Test 6 is not "Excellent" or "Good," do Self-Help Tests 19 to 22 on page 441.

Review Test 7: Multiplication of Fractions

You will have exactly *8 minutes* for this test. Your teacher will tell you when to begin. Be sure that your answers are in simplest form.

	A	B	C	D
Row 1	$\frac{3}{5}\times\frac{5}{12}$	$14\times\frac{1}{16}$	$\frac{11}{12}\times 10$	$7\times 1\frac{4}{5}$
Row 2	$6\frac{3}{4}\times 8$	$1\frac{1}{8}\times\frac{3}{5}$	$\frac{1}{10}\times 1\frac{2}{3}$	$4\frac{1}{16}\times 2\frac{1}{10}$

Standards for Review Test 7

Poor	Fair	Average	Good	Excellent
0–2	3–5	6	7	8

If your work on Review Test 7 is not "Excellent" or "Good," do Self-Help Tests 23 to 26 on page 447.

Review Test 8: Division of Fractions

You will have exactly *10 minutes* to do this test. Your teacher will tell you when to begin. Be sure your answers are in simplest form.

	A	B	C	D
Row 1	$\frac{1}{2}\div 4$	$16\div\frac{2}{3}$	$\frac{4}{5}\div\frac{2}{3}$	$4\frac{1}{2}\div 2\frac{7}{10}$
Row 2	$\frac{5}{6}\div 3\frac{3}{4}$	$1\frac{7}{12}\div 3$	$3\frac{3}{8}\div\frac{9}{10}$	$5\frac{5}{8}\div 3\frac{9}{10}$

Standards for Review Test 8

Poor	Fair	Average	Good	Excellent
0–1	2–4	5–6	7	8

If your work on Review Test 8 is not "Excellent" or "Good," do Self-Help Tests 27 to 30 on page 451.

Review Test 9: Multiplication of Decimals

This is a test to find out whether or not you know where to put the decimal point when you multiply decimals. The correct figures for the answer are given for each example, but the decimal point is missing. Study each example until you know where the decimal point belongs in the answer. Then copy the answer and put the decimal point in the right place. In some answers you will have to insert zeros. You will have exactly *3 minutes* in which to do this test.

	A	B	C	D	E
Row 1	42.4	424	.424	4.24	42.4
	201	.201	2.01	.201	20.1
	424	424	424	424	424
	8480	8480	8480	8480	8480
	85224	**85224**	**85224**	**85224**	**85224**
Row 2	42.4	.625	.065	.984	.25
	.201	.025	.025	.25	.24
	424	3125	325	4920	100
	8480	1250	130	1968	50
	85224	**15625**	**1625**	**24600**	**600**

Standards for Review Test 9

Poor	Fair	Average	Good	Excellent
0–6	7	8	9	10

If your work on Review Test 9 is not "Excellent" or "Good," do Self-Help Tests 32 to 34 on pages 454-455 to find out what review you need in multiplication of decimals.

Review Test 10: Division of Decimals

This is a test to find out whether or not you can place the decimal point correctly when you divide decimals. The correct figures for the answer are given for each example, but the decimal point is missing. Study each example until you know where the decimal point belongs in the answer. Then copy the answer and put the decimal point in the right place. In some answers you will have to insert zeros.

You will have exactly *4 minutes* in which to do this test. Your teacher will tell you when to begin.

	A	B	C
Row 1	$4.37\overline{)92.3818}$ answer 2114	$43.7\overline{)923.818}$ answer 2114	$437\overline{)9.23818}$ answer 2114
Row 2	$.437\overline{)9238.18}$ answer 2114	$4.37\overline{)9238.18}$ answer 2114	$4.37\overline{)923818}$ answer 2114
Row 3	$437\overline{).923818}$ answer 2114	$.437\overline{)923818}$ answer 2114	$.437\overline{)92381.8}$ answer 2114
Row 4	$14\overline{).00182}$ answer 13	$.014\overline{).182}$ answer 13	$304\overline{)76.00}$ answer 25

Standards for Review Test 10

Poor	Fair	Average	Good	Excellent
0–3	4–7	8–10	11	12

If your work on Review Test 10 is not "Excellent" or "Good," do Self-Help Tests 35 to 38 on page 455.

SELF-HELP TESTS AND PRACTICE*

Self-Help Tests in Addition

Test 1

		5					
		2	6			61	2
8	2	1	2	63	925	804	61
5	1	4	7	71	42	412	52
4	7	6	4	13	132	21	40

Test 2

	44				936	689
	85			763	99	311
63	68	39	784	407	474	435
92	38	68	639	369	32	894
69	60	4	985	470	471	337

If you make a mistake in a Self-Help Test, do the Self-Help Practice for that test. Self-Help 1 for Test 1 begins on this page. Self-Help 2 for Test 2 begins on page 423.

Self-Help Practice in Addition

Self-Help 1

Copy the examples at the top of the next page without the answers, close your book, and add. If your teacher approves, you may write just the answers on folded paper placed under each row of examples. Then compare your answers with the answers in the book. Work again any examples that you had wrong.

*To the Teacher: The scores made by the pupils on the Review Tests (pp. 415-421) indicate which pupils need remedial work. However, these Review Tests do not reveal specific individual difficulties. For this purpose more detailed diagnostic tests are needed. The Self-Help Tests meet this need.

For each Self-Help Test a block of remedial work is provided. These blocks of remedial work are designated as Self-Help 1, Self-Help 2, etc. Each block carries the same number as its corresponding Self-Help Test.

1.

				7		5	1		3
			3	5	8	0	5	1	4
	5	7	4	2	5	7	9	3	0
	2	5	1	4	5	1	0	3	7
	3	3	8	2	7	9	8	7	3
	10	**15**	**16**	**20**	**25**	**22**	**23**	**14**	**17**

2.

				62		4	624
	506		42	70		61	31
	312	83	331	45	727	72	812
	561	73	216	82	51	12	22
	1379	**156**	**589**	**259**	**778**	**149**	**1489**

Self-Help 2

To add in Example A, start at the bottom of the ones' column. Think: 0 and 6 are 6; 6 and 7 are 13; 13 and 8 are 21. Write 1 under the 0. Carry the 2 to the tens' column.

A
678
567
486
870
2601

Now add in the tens' column. Be sure to add the 2 that you carried. What figure should you write? What figure should you carry?

Add in the hundreds' column. What is the answer for Example A?

Do the following examples. Follow the directions given in Self-Help 1 for copying and working examples.

1.

						43
	87			847	104	170
	94	54	50	353	3869	8
	81	10	789	109	69	33
	51	89	413	466	5572	691
	313	**153**	**1252**	**1775**	**9614**	**945**

Go on to the next page.

2.	886					
	923	74	4286	61	190	73
	731	59	464	720	900	48
	545	20	179	86	975	579
	283	86	1283	788	322	67
				506	944	283
	3368	**239**	**6212**	**2161**	**3331**	**1050**

Self-Help Tests in Subtraction

Subtract in each of the tests below. If you make a mistake in any test, do the Self-Help for that test.

Test 3	38	98	968	749	499	486	557
	25	76	322	215	346	275	416

Test 4	67	976	895	724	8424	7267
	38	38	436	336	145	4759

Test 5	90	807	520	700	1008	5600
	38	55	214	84	829	216

Self-Help Practice in Subtraction

Self-Help 3

Copy the examples below without the answers, close your book, and subtract. Then work again any examples you had wrong.

1.	88	78	92	496	869	778	617
	61	25	41	72	413	317	515
	27	**53**	**51**	**424**	**456**	**461**	**102**

2.	52	97	76	45	733	869	975
	31	67	43	34	21	245	265
	21	**30**	**33**	**11**	**712**	**624**	**710**

Self-Help 4

To subtract in Example A, start in the ones' column. You cannot subtract 7 from the 4. You must take 1 from the 7 in the tens' column. Think of this 7 as 6 and the 4 as 14. Now subtract. 7 from 14 is 7.

Look at Step 2. You cannot subtract the 8 from the 6. Take 1 from the 5. Think of the 5 as 4 and the 6 as 16. Now finish subtracting.

A Step 1

$$\begin{array}{r} 6\;14 \\ 6\,5\,\cancel{7}\,\cancel{4} \\ \underline{3\,2\,8\,7} \\ 7 \end{array}$$

Step 2

$$\begin{array}{r} 16 \\ 4\;\cancel{6}\;14 \\ 6\,\cancel{5}\,\cancel{7}\,\cancel{4} \\ \underline{3\,2\,8\,7} \\ 3\,2\,8\,7 \end{array}$$

Subtract in the examples below. The directions for copying and working examples are given in Self-Help 3 on page 424.

1.	83	326	861	963	1962	4945
	35	19	542	46	295	2698
	48	**307**	**319**	**917**	**1667**	**2247**
2.	84	722	351	251	7166	8235
	28	276	295	16	4127	6395
	56	**446**	**56**	**235**	**3039**	**1840**

Self-Help 5

In Example B you cannot subtract 7 from 0. You cannot take 1 from the other 0 to change the 0 over the 7 to 10.

You must take 1 from the 8. Think of the 8 as 7 and think of the 0 next to it as 10. Then take 1 from this 10. Think of the 10 as 9 and think of the 0 over the 7 as 10. Now subtract. 7 from 10 is 3. 3 from 9 is 6. 6 from 7 is 1. 2 from 4 is 2. What is the answer for Example B?

B

$$\begin{array}{r} 9 \\ 7\;\cancel{10}\;10 \\ 4\,\cancel{8}\,\cancel{0}\,\cancel{0} \\ \underline{2\,6\,3\,7} \\ 2\,1\,6\,3 \end{array}$$

Go on to the next page.

In Example C you cannot subtract 3 from 2. You cannot take 1 from either the 0 above 9 or the 0 above 6.

C

$$\begin{array}{r} {\scriptstyle 9\,9} \\ {\scriptstyle 8\,10\,10\,12} \\ \cancel{9}\cancel{0}\cancel{0}\cancel{2} \\ \underline{3693} \\ 5309 \end{array}$$

You must take 1 from the 9 in the thousands' column. Think of this 9 as 8 and think of the 0 next to it as 10. Then take 1 from this 10. Think of the 10 as 9 and think of the other 0 as 10. Now take 1 from this 10. Think of this 10 as 9 and think of the 2 as 12.

Now subtract. Is 5309 the correct answer?

Copy and work the examples below. Follow the directions given in Self-Help 3 on page 424.

1.	303	800	903	200	770	4005
	57	468	79	28	384	2976
	246	**332**	**824**	**172**	**386**	**1029**
2.	690	900	706	420	8006	20040
	95	386	249	97	5990	9852
	595	**514**	**457**	**323**	**2016**	**10188**

Self-Help Tests in Multiplication

Multiply in the tests below. If you make a mistake in any test, do the Self-Help with the same number as the test. Self-Help 6 for Test 6 is on page 427.

Test 6	51	18	712	391	4283	1397
	2	6	8	7	3	5
Test 7	74	236	98	873	2142	5196
	21	25	67	314	162	2684
Test 8	37	901	609	748	618	2534
	40	90	501	107	850	408

Self-Help Practice in Multiplication

Self-Help 6

A
6872
9
61848

To multiply in Example A, first think: 9×2 is 18. Write 8. Carry 1.

Now think: 9×7 is 63. Add the 1 that you carried. Write __. Carry __. Finish multiplying.

Is 61,848 the correct answer for Example A?

Copy the examples below, close your book, and multiply. Compare your answers with the answers in the book. Work again any examples you had wrong.

1.	25 7	54 5	487 9	375 6	8379 8	1569 3
2.	80 2	98 4	695 3	746 7	5263 9	2065 7

Answers

1.	175	270	4383	2250	67,032	4707
2.	160	392	2085	5222	47,367	14,455

Self-Help 7

B
692
593
2076
6228
3460
410356

To multiply 692 by 593, multiply by 3 first. 3×692 is 2076. Is 2076 written in the right place? Now multiply by 9. Is 6228 correct? Notice that the 8 in 6228 is written directly under the 9 in 593. Multiply by 5. Is 3460 written in the right place?

Now add. Is the answer correct?

Go on to the next page.

Multiply in the examples below. Follow the directions in Self-Help 6 for copying and working examples.

1.	937	250	74	253	59	634
	68	96	32	725	51	48

2.	37	461	9055	945	6158
	28	437	258	179	431

Answers

1. 63,716 24,000 2368 183,425 3009 30,432

2. 1036 201,457 2,336,190 169,155 2,654,098

Self-Help 8

To multiply 819 by 760, multiply by 0 first. 0×819 is 0. Write 0 under the 0 that you multiplied by.

Next multiply by 6. 6×819 is 4914. Write the 4 at the left of the 0 and directly under the 6 in 760.

Now multiply by 7. Is 5733 correct?

C
819
760
49140
5733
622440

In Example D multiply first by 7. 7×792 is 5544.

Multiply by 0. 0×792 is 0. Write 0 under 4 in the same column as the 0 that you multiplied by. Now multiply by 5. 5×792 is 3960. Is 3960 written so that the 0 is in the same column as the 5 that you multiplied by?

D
792
507
5544
39600
401544

Add. Is 401,544 the correct answer for Example D?

Go on to the next page.

Copy the examples below, close your book, and multiply. Compare your answers with the answers in the book. Work again any examples you had wrong.

1.	94	79	581	843	4794
	50	60	400	290	308
2.	2986	257	4623	756	683
	507	60	609	130	409
3.	152	9234	619	985	234
	80	900	940	408	700

Answers

1.	4700	4740	232,400	244,470	1,476,552
2.	1,513,902	15,420	2,815,407	98,280	279,347
3.	12,160	8,310,600	581,860	401,880	163,800

Self-Help Tests in Division

Divide in the tests below. If you make a mistake in any test, do the Self-Help with the same number as the test. Self-Help 9 for Test 9 is on page 430.

Test 9	$4\overline{)71}$	$8\overline{)549}$	$9\overline{)747}$	$5\overline{)8585}$	$7\overline{)96137}$
Test 10	$37\overline{)89}$	$85\overline{)3655}$	$75\overline{)233}$	$34\overline{)17729}$	
Test 11	$84\overline{)2532}$	$17\overline{)3437}$	$30\overline{)15020}$	$23\overline{)46069}$	
Test 12	$29\overline{)663}$	$45\overline{)3592}$	$19\overline{)4970}$	$56\overline{)22310}$	
Test 13	$628\overline{)7384}$	$236\overline{)6486}$	$364\overline{)65470}$	$543\overline{)83492}$	

Self-Help Practice in Division

Self-Help 9

In Example A, first think: 9 into 72 is 8. Write 8 above the 2 in 72. Then multiply. 8×9 is 72. Write 72 under 72. Subtract. 72−72 is 0. Do not write this 0.

Bring down the 5 in 7257. 9 into 5 is 0. Write 0 in the answer and bring down 7.

A

$$\begin{array}{r} 806\frac{1}{3} \\ 9\overline{)7257} \\ \underline{72} \\ 57 \\ \underline{54} \\ \cancel{3} \end{array}$$

How do you get the 6 in the answer? The 54? The 3 remainder? Why is the remainder written as $\frac{1}{3}$?

Copy the examples below, close your book, and divide. Compare your answers with those in the book. Work again any examples you had wrong.

1. $8\overline{)6547}$ $9\overline{)349}$ $6\overline{)4861}$ $7\overline{)8650}$ $5\overline{)314}$

2. $9\overline{)7057}$ $3\overline{)1439}$ $4\overline{)87956}$ $8\overline{)95773}$

Answers

1. $818\frac{3}{8}$ $38\frac{7}{9}$ $810\frac{1}{6}$ $1235\frac{5}{7}$ $62\frac{4}{5}$

2. $784\frac{1}{9}$ $479\frac{2}{3}$ 21,989 $11971\frac{5}{8}$

Self-Help 10

In Example B try 6 into 16 to find how many times 61 will go into 164. 6 into 16 is 2. Where is 2 written?

Multiply. 2×61 = 122. Write 122.
Subtract. 164−122 = 42. Write 42.
Compare. Is 42 smaller than 61?

B

$$\begin{array}{r} 27 \\ 61\overline{)1647} \\ \underline{122} \\ 427 \\ \underline{427} \end{array}$$

Go on to the next page.

Bring down 7. Divide. 6 into 42 is 7; so 61 will probably go into 427 seven times. Write 7 in the answer. Finish the example. Is there a remainder? Is 27 the correct answer for Example B?

Divide in the examples below. Follow the directions given in Self-Help 9 for copying and working examples.

1. 93)281 42)89 51)564 27)58 31)713

2. 63)1449 82)1897 72)16848 25)18287

Answers

1. $3\frac{2}{93}$, $2\frac{5}{42}$, $11\frac{1}{17}$, $2\frac{4}{27}$, 23 **2.** 23, $23\frac{11}{82}$, 234, $731\frac{12}{25}$

Self-Help 11

In Example C try 9 into 73 to find how many times 92 will go into 737. 9 into 73 is 8. Write 8.

Multiply, subtract, and compare.

Bring down 8. 92 will not go into 18. Write 0 in the answer. Bring down 4. How do you get 2 in the answer? Is there a remainder?

```
C
       802
   92)73784
      736
        184
        184
```

Divide in the examples below. Follow the directions in Self-Help 9 for copying and working examples.

1. 67)3364 54)5508 86)2623 47)9400

2. 98)11796 65)39329 30)32400 74)74037

Answers

1. $50\frac{14}{67}$ 102 $30\frac{1}{2}$ 200

2. $120\frac{18}{49}$ $605\frac{4}{65}$ 1080 $1000\frac{1}{2}$

Self-Help 12

Look at Example D. The first number tried in the answer was 8 because the 5 in 58 goes into the 44 in 442 eight times.

```
D
          76 8/29
    58 ) 4424
         406
         ---
          364
          348
          ---
           16
```

$8 \times 58 = 464$. 464 is larger than 442; so 8 is too large for the answer.

Then 7, the next number smaller than 8, was tried in the answer. How can you tell that the 7 in the answer is correct?

What numbers were tried for 58 into 364? How do you know *that 6 is correct?*

How do you get the fraction $\frac{8}{29}$ in the answer?

Look at Example E. How many times does 14 go into 120? 1 into 12 is 12, but you never try a number larger than 9 in the answer.

```
E
          86
    14 ) 1204
         112
         ---
          84
          84
          --
```

9×14 is 126. 9 is too large. Try 8, the next smaller number. How do you know 8 is the correct number?

What numbers do you try for 14 into 84? How do you know that 6 is the correct number?

Divide in the examples below. Follow the directions in Self-Help 9 on page 430 for copying and working examples.

1.	47)880	45)2080	24)624	68)5576
2.	17)367	13)9594	40)2419	26)2158
3.	21)1842	36)2124	59)3319	48)9888

Answers

1. $18\frac{34}{47}$, $46\frac{2}{9}$, 26, 82 **2.** $21\frac{10}{17}$, 738, $60\frac{19}{40}$, 83

3. $87\frac{5}{7}$, 59, $56\frac{15}{59}$, 206

Self-Help 13

```
F
           92
    852)78384
        7668
         1704
         1704
```

852 will not go into 7, 78, or 783. How many times will 852 go into 7838? To find out, try 8 into 78. 8 into 78 is 9. Notice where 9 is written in the answer.

Multiply. 9×852 is 7668. How do you know that 9 is the correct number to use in the answer? Now try 8 into 17. Finish the example. Is 92 the correct answer?

```
G
           56 43/56
    448)25432
        2240
         3032
         2688
          344
```

Look at Example G. To find how many times 448 goes into 2543, try 4 into 25. 4 into 25 is 6.

Multiply. 6×448 is 2688. Is 6 too large? How do you know?

Try 5. Why is 5 the correct number to use?

How do you get 6 in the answer?

Is there a remainder? How do you get the $\frac{43}{56}$?

Divide in the examples below. Use the directions in Self-Help 9 for copying and working examples.

1. 361)6859 765)7995 850)30600 816)6549

2. 315)24593 175)4925 208)38688 550)21525

Answers

1. 19, $10\frac{23}{51}$, 36, $8\frac{7}{272}$ **2.** $78\frac{23}{315}$, $28\frac{1}{7}$, 186, $39\frac{3}{22}$

Self-Help Practice in Changing Fractions

Self-Help 14

A. A fraction in an answer should always be in simplest form. A proper fraction is in simplest form when 1 is the only number that goes into both the numerator and the denominator without a remainder. Why is the fraction $\frac{3}{5}$ in simplest form? $\frac{12}{18}$ is not in simplest form because both the numerator, 12, and the denominator, 18, can be divided exactly by 2, 3, or 6.

To change $\frac{12}{18}$ to simplest form, divide both the numerator and the denominator by the largest number that will go into both exactly. That number is 6. $\frac{12}{18}=\frac{12 \div 6}{18 \div 6}=\frac{2}{3}$.

Look at the fractions below. If any of them are not in simplest form, change them. Then compare your answers with the correct answers on page 436.

1.	$\frac{4}{16}$	$\frac{9}{10}$	$\frac{6}{8}$	$\frac{6}{18}$	$\frac{3}{4}$	$\frac{4}{12}$	$\frac{10}{20}$	$\frac{8}{12}$
2.	$\frac{2}{10}$	$\frac{3}{6}$	$\frac{9}{15}$	$\frac{9}{20}$	$\frac{13}{16}$	$\frac{18}{24}$	$\frac{6}{12}$	$\frac{5}{6}$

B. $\frac{4}{4}$, $\frac{9}{3}$, and $\frac{13}{6}$ are improper fractions. An improper fraction equals 1 or more than 1. Always change an improper fraction in an answer to simplest form.

To change $\frac{9}{3}$ to simplest form, divide 9 by 3. $9 \div 3$ is 3. 3 is the simplest form of $\frac{9}{3}$. To change $\frac{13}{6}$ to simplest form, divide __ by __. $13 \div 6$ is $2\frac{1}{6}$.

To change $\frac{6}{4}$ to simplest form, divide __ by __. $6 \div 4$ is $1\frac{2}{4}$. $1\frac{2}{4}$ is not yet in simplest form. Why? $1\frac{2}{4}=1\frac{1}{2}$. $1\frac{1}{2}$ is the simplest form of $\frac{6}{4}$.

To change an improper fraction to simplest form, change it to a whole number or a mixed number. To do this, divide the numerator by the denominator.

Change each fraction below to simplest form. Compare your answers with the answers on page 436.

3.	$\frac{4}{3}$	$\frac{10}{10}$	$\frac{20}{16}$	$\frac{11}{6}$	$\frac{6}{5}$	$\frac{12}{8}$	$\frac{22}{12}$	$\frac{5}{4}$
4.	$\frac{16}{8}$	$\frac{14}{10}$	$\frac{7}{5}$	$\frac{30}{20}$	$\frac{19}{16}$	$\frac{8}{6}$	$\frac{16}{12}$	$\frac{8}{2}$

C. Sometimes you will get a number like $4\frac{6}{6}$ in an answer. It is not in simplest form. You know that $\frac{6}{6}$ is equal to 1; so $4\frac{6}{6}$ equals $4+1$, or 5. 5 is the simplest form of $4\frac{6}{6}$.

To change $2\frac{14}{6}$ to simplest form, think: "$\frac{14}{6}=2\frac{2}{6}$. $2\frac{14}{6}=2+2\frac{2}{6}=4\frac{2}{6}$. $4\frac{2}{6}=4\frac{1}{3}$."

Change the mixed numbers below to simplest form. Compare your answers with the answers on page 436.

5.	$6\frac{13}{12}$	$10\frac{23}{20}$	$8\frac{30}{24}$	$2\frac{46}{30}$	$3\frac{9}{6}$	$5\frac{14}{10}$
6.	$6\frac{2}{2}$	$7\frac{7}{5}$	$1\frac{14}{8}$	$2\frac{17}{16}$	$3\frac{6}{4}$	$1\frac{7}{3}$
7.	$4\frac{10}{8}$	$3\frac{11}{6}$	$9\frac{25}{5}$	$2\frac{5}{4}$	$5\frac{30}{20}$	$6\frac{12}{8}$

D. You must often change a fraction to an equal fraction with a larger denominator. To change $\frac{2}{3}$ to twelfths, divide 12, the new denominator, by 3, the denominator of $\frac{2}{3}$. $12\div 3=4$. Now multiply both the numerator and the denominator of $\frac{2}{3}$ by 4. $\frac{2}{3}=\frac{4\times 2}{4\times 3}=\frac{8}{12}$.

To change $\frac{5}{8}$ to twenty-fourths, first divide 24 by __. $24\div 8=$ __. Now multiply both the numerator and the denominator of $\frac{5}{8}$ by 3. $\frac{5}{8}=\frac{3\times 5}{3\times 8}=\frac{15}{24}$. $\frac{5}{8}$ is equal to $\frac{15}{24}$.

What number belongs where each question mark is? Compare your answers with those on page 436.

8.	$\frac{1}{4}=\frac{?}{12}$	$\frac{1}{2}=\frac{?}{4}$	$\frac{3}{10}=\frac{?}{20}$	$\frac{1}{3}=\frac{?}{12}$	$2\frac{1}{8}=2\frac{?}{24}$
9.	$\frac{2}{3}=\frac{?}{6}$	$\frac{4}{5}=\frac{?}{10}$	$\frac{5}{6}=\frac{?}{12}$	$\frac{3}{8}=\frac{?}{16}$	$3\frac{2}{3}=3\frac{?}{12}$

E. Sometimes a mixed number must be changed to an improper fraction. To change $4\frac{1}{5}$ to an improper fraction, think: "There are 5 fifths in 1. So there must be 4×5 fifths, or 20 fifths, in 4. 20 fifths and 1 fifth are 21 fifths. $4\frac{1}{5} = \frac{21}{5}$."

Change the mixed numbers below to improper fractions. Compare your answers with those below.

10.	$2\frac{3}{4}$	$6\frac{2}{3}$	$11\frac{2}{5}$	$8\frac{4}{5}$	$2\frac{7}{8}$	$3\frac{3}{12}$
11.	$3\frac{4}{10}$	$9\frac{1}{3}$	$4\frac{5}{6}$	$3\frac{1}{6}$	$2\frac{5}{12}$	$2\frac{7}{16}$

Answers

1. $\frac{4}{16} = \frac{1}{4}$ $\frac{6}{8} = \frac{3}{4}$ $\frac{6}{18} = \frac{1}{3}$ $\frac{4}{12} = \frac{1}{3}$ $\frac{10}{20} = \frac{1}{2}$ $\frac{8}{12} = \frac{2}{3}$

2. $\frac{2}{10} = \frac{1}{5}$ $\frac{3}{6} = \frac{1}{2}$ $\frac{9}{15} = \frac{3}{5}$ $\frac{18}{24} = \frac{3}{4}$ $\frac{6}{12} = \frac{1}{2}$

3. $1\frac{1}{3}$ 1 $1\frac{1}{4}$ $1\frac{5}{6}$ $1\frac{1}{5}$ $1\frac{1}{2}$ $1\frac{5}{6}$ $1\frac{1}{4}$

4. 2 $1\frac{2}{5}$ $1\frac{2}{5}$ $1\frac{1}{2}$ $1\frac{3}{16}$ $1\frac{1}{3}$ $1\frac{1}{3}$ 4

5. $7\frac{1}{12}$, $11\frac{3}{20}$, $9\frac{1}{4}$, $3\frac{8}{15}$, $4\frac{1}{2}$, $6\frac{2}{5}$ **6.** 7, $8\frac{2}{5}$, $2\frac{3}{4}$, $3\frac{1}{16}$, $4\frac{1}{2}$, $3\frac{1}{3}$

7. $5\frac{1}{4}$, $4\frac{5}{6}$, 14, $3\frac{1}{4}$, $6\frac{1}{2}$, $7\frac{1}{2}$ **8.** $\frac{3}{12}$, $\frac{2}{4}$, $\frac{6}{20}$, $\frac{4}{12}$, $2\frac{3}{24}$

9. $\frac{4}{6}$, $\frac{8}{10}$, $\frac{10}{12}$, $\frac{6}{16}$, $3\frac{8}{12}$ **10.** $\frac{11}{4}$, $\frac{20}{3}$, $\frac{57}{5}$, $\frac{44}{5}$, $\frac{23}{8}$, $\frac{39}{12}$

11. $\frac{34}{10}$, $\frac{28}{3}$, $\frac{29}{6}$, $\frac{19}{6}$, $\frac{29}{12}$, $\frac{39}{16}$

Self-Help Tests in Addition of Fractions

Add in Tests 15 to 18. If you have forgotten how to change answers to simplest form, turn now to Self-Help 14 on page 434 and study sections A, B, and C.

Test 15	$\frac{1}{4}$	$\frac{4}{5}$	$\frac{5}{6}$	$5\frac{1}{4}$	$\frac{3}{5}$	$\frac{1}{3}$
	$\frac{3}{4}$	$\frac{2}{5}$	$\frac{5}{6}$	7	6	$\frac{1}{3}$

Test 16	$\frac{3}{4}$	$\frac{2}{3}$	$\frac{3}{10}$	$\frac{1}{3}$	$\frac{1}{2}$	$\frac{4}{5}$
	$\frac{5}{6}$	$\frac{1}{6}$	$\frac{2}{5}$	$\frac{1}{12}$	$\frac{5}{8}$	$\frac{9}{10}$

Test 17	$8\frac{1}{8}$	$4\frac{7}{16}$	$5\frac{7}{12}$	$6\frac{2}{3}$	$4\frac{1}{3}$	$5\frac{1}{4}$
	$\underline{2\frac{5}{8}}$	$\underline{\frac{5}{16}}$	$\underline{7\frac{1}{6}}$	$\underline{1\frac{1}{8}}$	$\underline{5\frac{1}{5}}$	$\underline{\frac{2}{5}}$

	$\frac{2}{3}$	$2\frac{3}{5}$	$8\frac{1}{3}$	$10\frac{3}{4}$	$\frac{5}{8}$	9
Test 18	$\frac{1}{5}$	$\frac{3}{10}$	$\frac{1}{6}$	$\frac{1}{12}$	$\frac{1}{2}$	$1\frac{1}{8}$
	$\underline{\frac{1}{3}}$	$\underline{6\frac{1}{4}}$	$\underline{\frac{1}{12}}$	$\underline{7\frac{1}{6}}$	$\underline{\frac{5}{16}}$	$\underline{7\frac{1}{4}}$

If you made a mistake in any test above, do the Self-Help for that test. Self-Help 15 for Test 15 begins on this page.

Self-Help Practice in Addition of Fractions

Self-Help 15

In Example A both fractions have the same denominator. You can add them without changing either denominator.

To find the sum of $\frac{3}{16}$ and $\frac{5}{16}$, add the numerators. $3+5=8$. Write 8 above the denominator, 16. $\frac{3}{16}+\frac{5}{16}=\frac{8}{16}$.

Why is $\frac{8}{16}$ changed to $\frac{1}{2}$?

Look at Example B. Notice that the fraction $\frac{11}{12}$ is written in a separate column. Add the fraction column first.

Now add 3 and 6. Is the answer correct? Is it in simplest form? How do you know?

A	
	$\frac{3}{16}$
	$\underline{\frac{5}{16}}$
	$\frac{8}{16}=\frac{1}{2}$

B	
	6
	$\underline{3\frac{11}{12}}$
	$9\frac{11}{12}$

Copy the examples at the top of the next page, close your book, and add. Be sure that your answers are in simplest form. Compare your answers with the answers at the end of the Self-Help. Correct any mistakes.

1.	$\frac{3}{4}$	$\frac{1}{5}$	$\frac{1}{3}$	$\frac{1}{3}$	$\frac{3}{5}$	$\frac{3}{10}$	$7\frac{3}{16}$	$\frac{3}{10}$
	$\underline{\frac{1}{4}}$	$\underline{\frac{3}{5}}$	$\underline{\frac{2}{3}}$	$\underline{\frac{1}{3}}$	$\underline{\frac{4}{5}}$	$\underline{4}$	$\underline{5}$	$\underline{\frac{3}{10}}$
2.	$\frac{2}{5}$	$\frac{1}{12}$	$8\frac{9}{10}$	$\frac{1}{6}$	$\frac{5}{16}$	$\frac{1}{5}$	$\frac{2}{5}$	$\frac{3}{16}$
	$\underline{\frac{3}{5}}$	$\underline{\frac{7}{12}}$	$\underline{6}$	$\underline{\frac{1}{6}}$	$\underline{5}$	$\underline{\frac{1}{5}}$	$\underline{\frac{1}{5}}$	$\underline{\frac{1}{16}}$

Answers

1.	1	$\frac{4}{5}$	1	$\frac{2}{3}$	$1\frac{2}{5}$	$4\frac{3}{10}$	$12\frac{3}{16}$	$\frac{3}{5}$
2.	1	$\frac{2}{3}$	$14\frac{9}{10}$	$\frac{1}{3}$	$5\frac{5}{16}$	$\frac{2}{5}$	$\frac{3}{5}$	$\frac{1}{4}$

Self-Help 16

C

$$\frac{2}{3} = \frac{8}{12}$$
$$\frac{7}{12} = \frac{7}{12}$$
$$\frac{15}{12} = 1\frac{1}{4}$$

In Example C the fractions do not have the same denominator. Change $\frac{2}{3}$ to twelfths before you add. $\frac{2}{3}=\frac{8}{12}$.

Now add the numerators of $\frac{8}{12}$ and $\frac{7}{12}$. $8+7=15$. Write 15 in the answer over the denominator __.

If you do not know how to change $\frac{15}{12}$ to $1\frac{1}{4}$, study section B in Self-Help 14.

D

$$\frac{3}{4} = \frac{9}{12}$$
$$\frac{2}{3} = \frac{8}{12}$$
$$\frac{17}{12} = 1\frac{5}{12}$$

In Example D the denominator to use is the smallest number that can be divided exactly by both 4 and 3. To find this number, try 2 times 4, the larger denominator. 2×4 is 8, but 8 cannot be divided exactly by 3.

Try 3 times 4. 3×4 is 12. How do you know that 12 is the correct denominator to use?

Now change $\frac{3}{4}$ and $\frac{2}{3}$ to twelfths. Then add.

Why should you change $\frac{17}{12}$ to $1\frac{5}{12}$?

Copy the examples at the top of the next page and add. Follow the directions in Self-Help 15 on page 437.

1.	$\begin{array}{r}\frac{2}{3}\\ \underline{\frac{5}{12}}\end{array}$	$\begin{array}{r}\frac{3}{4}\\ \underline{\frac{3}{8}}\end{array}$	$\begin{array}{r}\frac{7}{16}\\ \underline{\frac{3}{4}}\end{array}$	$\begin{array}{r}\frac{2}{5}\\ \underline{\frac{9}{10}}\end{array}$	$\begin{array}{r}\frac{3}{16}\\ \underline{\frac{3}{8}}\end{array}$	$\begin{array}{r}\frac{5}{6}\\ \underline{\frac{2}{3}}\end{array}$	$\begin{array}{r}\frac{11}{12}\\ \underline{\frac{3}{4}}\end{array}$	$\begin{array}{r}\frac{3}{5}\\ \underline{\frac{1}{3}}\end{array}$
2.	$\begin{array}{r}\frac{5}{6}\\ \underline{\frac{7}{12}}\end{array}$	$\begin{array}{r}\frac{4}{5}\\ \underline{\frac{1}{4}}\end{array}$	$\begin{array}{r}\frac{1}{2}\\ \underline{\frac{7}{8}}\end{array}$	$\begin{array}{r}\frac{2}{3}\\ \underline{\frac{2}{5}}\end{array}$	$\begin{array}{r}\frac{4}{5}\\ \underline{\frac{3}{10}}\end{array}$	$\begin{array}{r}\frac{1}{3}\\ \underline{\frac{1}{4}}\end{array}$	$\begin{array}{r}\frac{1}{2}\\ \underline{\frac{3}{10}}\end{array}$	$\begin{array}{r}\frac{2}{3}\\ \underline{\frac{3}{4}}\end{array}$
3.	$\begin{array}{r}\frac{7}{8}\\ \underline{\frac{15}{16}}\end{array}$	$\begin{array}{r}\frac{3}{5}\\ \underline{\frac{3}{4}}\end{array}$	$\begin{array}{r}\frac{1}{2}\\ \underline{\frac{1}{4}}\end{array}$	$\begin{array}{r}\frac{7}{10}\\ \underline{\frac{3}{4}}\end{array}$	$\begin{array}{r}\frac{5}{8}\\ \underline{\frac{1}{16}}\end{array}$	$\begin{array}{r}\frac{1}{6}\\ \underline{\frac{1}{4}}\end{array}$	$\begin{array}{r}\frac{1}{2}\\ \underline{\frac{1}{6}}\end{array}$	$\begin{array}{r}\frac{7}{8}\\ \underline{\frac{5}{6}}\end{array}$

Answers

1.	$1\frac{1}{12}$	$1\frac{1}{8}$	$1\frac{3}{16}$	$1\frac{3}{10}$	$\frac{9}{16}$	$1\frac{1}{2}$	$1\frac{2}{3}$	$\frac{14}{15}$
2.	$1\frac{5}{12}$	$1\frac{1}{20}$	$1\frac{3}{8}$	$1\frac{1}{15}$	$1\frac{1}{10}$	$\frac{7}{12}$	$\frac{4}{5}$	$1\frac{5}{12}$
3.	$1\frac{13}{16}$	$1\frac{7}{20}$	$\frac{3}{4}$	$1\frac{9}{20}$	$\frac{11}{16}$	$\frac{5}{12}$	$\frac{2}{3}$	$1\frac{17}{24}$

Self-Help 17

E	F	G
$\begin{array}{rcl} 6\frac{1}{2} & = & 6\frac{5}{10} \\ \underline{1\frac{2}{5}} & = & \underline{1\frac{4}{10}} \\ & & 7\frac{9}{10} \end{array}$	$\begin{array}{l} 4\frac{1}{6} \\ \underline{3\frac{5}{6}} \\ 7\frac{6}{6} = 7 + 1 = 8 \end{array}$	$\begin{array}{rcl} 5\frac{1}{3} & = & 5\frac{2}{6} \\ \underline{\frac{5}{6}} & = & \underline{\frac{5}{6}} \\ & & 5\frac{7}{6} = 6\frac{1}{6} \end{array}$

Study the work in Example E above. Add the fraction column first. Is $\frac{9}{10}$ correct? Now add the whole numbers. Is the answer in simplest form?

How do you get $7\frac{6}{6}$ in Example F? Can you change $7\frac{6}{6}$ to 8? If not, study B and C in Self-Help 14, page 434.

Look at Example G. How do you get $5\frac{7}{6}$ in the answer? How do you change $5\frac{7}{6}$ to $6\frac{1}{6}$?

Now do the examples at the top of the next page.

Copy the examples below and add. Then compare your answers with the printed ones. Correct any mistakes you make.

1.	$4\frac{1}{4}$	$\frac{2}{5}$	$5\frac{2}{3}$	$7\frac{1}{4}$	$\frac{2}{3}$	$6\frac{7}{16}$
	$2\frac{5}{16}$	$8\frac{1}{10}$	$6\frac{1}{3}$	$\frac{2}{5}$	$3\frac{1}{8}$	$2\frac{5}{16}$
2.	$6\frac{1}{4}$	$2\frac{1}{6}$	$10\frac{1}{6}$	$3\frac{1}{8}$	$\frac{1}{4}$	$2\frac{3}{16}$
	$3\frac{3}{8}$	$\frac{5}{8}$	$\frac{1}{12}$	$5\frac{3}{4}$	$3\frac{1}{5}$	$8\frac{5}{16}$

Answers

1.	$6\frac{9}{16}$	$8\frac{1}{2}$	12	$7\frac{13}{20}$	$3\frac{19}{24}$	$8\frac{3}{4}$
2.	$9\frac{5}{8}$	$2\frac{19}{24}$	$10\frac{1}{4}$	$8\frac{7}{8}$	$3\frac{9}{20}$	$10\frac{1}{2}$

Self-Help 18

H

$$2\frac{1}{2} = 2\frac{6}{12}$$
$$\frac{2}{3} = \frac{8}{12}$$
$$1\frac{1}{4} = 1\frac{3}{12}$$
$$3\frac{17}{12} = 4\frac{5}{12}$$

Look at Example H. The denominator to use in adding is the smallest number that can be divided exactly by 2, 3, and 4.

Try 2 times the largest denominator. $2\times4=8$. Why is 8 not the right denominator to use?

Try 3×4. Why is 12 the denominator to use? Change $\frac{1}{2}$, $\frac{2}{3}$, and $\frac{1}{4}$ to twelfths. How do you get $\frac{17}{12}$? Why do you change $3\frac{17}{12}$ to $4\frac{5}{12}$?

Copy the examples below and add. Compare your answers with those on page 441 and correct any mistakes.

1.	$\frac{3}{4}$	$4\frac{1}{4}$	$5\frac{1}{6}$	$3\frac{1}{10}$	$3\frac{1}{4}$	3
	$\frac{1}{2}$	$3\frac{1}{4}$	$4\frac{2}{3}$	$\frac{2}{5}$	$\frac{5}{6}$	$5\frac{2}{3}$
	$\frac{7}{8}$	$\frac{3}{4}$	$\frac{1}{6}$	$1\frac{1}{2}$	$6\frac{1}{3}$	$6\frac{3}{4}$

2.	$12\frac{1}{6}$	$6\frac{1}{3}$	$\frac{3}{4}$	$15\frac{2}{3}$	$\frac{5}{6}$	$2\frac{7}{8}$
	$2\frac{2}{3}$	$18\frac{1}{2}$	$\frac{3}{8}$	$3\frac{3}{8}$	$\frac{5}{6}$	$1\frac{5}{6}$
	$10\frac{3}{8}$	$\frac{3}{4}$	$\frac{3}{8}$	$10\frac{1}{12}$	$\frac{3}{4}$	$5\frac{5}{8}$

Answers

1.	$2\frac{1}{8}$	$8\frac{1}{4}$	10	5	$10\frac{5}{12}$	$15\frac{5}{12}$
2.	$25\frac{5}{24}$	$25\frac{7}{12}$	$1\frac{1}{2}$	$29\frac{1}{8}$	$2\frac{5}{12}$	$10\frac{1}{3}$

Self-Help Tests in Subtraction of Fractions

Subtract in each test below. If you need help in changing answers to simplest form, study section A in Self-Help 14 on page 434.

Test 19	$\frac{2}{3}$	$\frac{7}{12}$	$5\frac{3}{4}$	$9\frac{5}{8}$	$\frac{7}{10}$	$\frac{2}{5}$
	$\frac{1}{3}$	$\frac{1}{12}$	$\frac{1}{4}$	2	$\frac{1}{10}$	$\frac{2}{5}$
Test 20	$\frac{3}{4}$	$6\frac{1}{2}$	$\frac{5}{12}$	$3\frac{5}{12}$	$\frac{7}{8}$	$7\frac{7}{10}$
	$\frac{1}{2}$	$4\frac{1}{8}$	$\frac{1}{3}$	$\frac{1}{4}$	$\frac{3}{4}$	$2\frac{3}{5}$
Test 21	7	3	9	2	8	6
	$\frac{15}{16}$	$1\frac{2}{3}$	$8\frac{7}{12}$	$\frac{1}{4}$	$3\frac{3}{10}$	$\frac{2}{5}$
Test 22	$2\frac{1}{3}$	$8\frac{2}{3}$	$8\frac{1}{5}$	$5\frac{3}{5}$	$11\frac{1}{3}$	$7\frac{1}{4}$
	$\frac{1}{2}$	$4\frac{7}{8}$	$7\frac{1}{3}$	$\frac{4}{5}$	$5\frac{3}{4}$	$\frac{7}{16}$

If you made a mistake in any test above, do the Self-Help with the same number as the test. For example, if you made a mistake in Test 19, do Self-Help 19 on pages 442 and 443.

Self-Help Practice in Subtraction of Fractions

Self-Help 19

A	B	C
$\begin{array}{r} \frac{9}{10} \\ \underline{\frac{3}{10}} \\ \frac{6}{10} = \frac{3}{5} \end{array}$	$\begin{array}{r} 6\frac{3}{4} \\ \underline{\frac{1}{4}} \\ 6\frac{2}{4} = 6\frac{1}{2} \end{array}$	$\begin{array}{r} 8\frac{5}{6} \\ \underline{1\phantom{\frac{5}{6}}} \\ 7\frac{5}{6} \end{array}$

In Example A above you can subtract without changing either fraction because both fractions have the same denominator. Subtract the numerators. $9-3=6$. Write 6 above the denominator 10 in the answer.

Why is $\frac{6}{10}$ changed to $\frac{3}{5}$?

In Example B notice that the fractions are written in a column. Are both denominators the same? Subtract the $\frac{1}{4}$ from the $\frac{3}{4}$. Is the $\frac{2}{4}$ in the answer correct?

Since there is nothing to subtract from 6, write 6 in the answer. Why is $6\frac{2}{4}$ changed to $6\frac{1}{2}$?

In Example C there is nothing to subtract from $\frac{5}{6}$. Write $\frac{5}{6}$ in the answer. Now subtract 1 from 8. Is $7\frac{5}{6}$ in simplest form?

Copy the examples below, close your book, and subtract. Be sure your answers are in simplest form. Compare your answers with the answers at the end of this Self-Help. Correct any mistakes you make.

1.	$\begin{array}{r} \frac{1}{2} \\ \underline{\frac{1}{2}} \end{array}$	$\begin{array}{r} \frac{15}{16} \\ \underline{\frac{11}{16}} \end{array}$	$\begin{array}{r} \frac{5}{6} \\ \underline{\frac{1}{6}} \end{array}$	$\begin{array}{r} \frac{3}{4} \\ \underline{\frac{1}{4}} \end{array}$	$\begin{array}{r} \frac{11}{12} \\ \underline{\frac{7}{12}} \end{array}$	$\begin{array}{r} \frac{4}{5} \\ \underline{\frac{1}{5}} \end{array}$	$\begin{array}{r} \frac{9}{10} \\ \underline{\frac{9}{10}} \end{array}$
2.	$\begin{array}{r} 7\frac{5}{6} \\ \underline{4} \end{array}$	$\begin{array}{r} 9\frac{5}{8} \\ \underline{\frac{1}{8}} \end{array}$	$\begin{array}{r} 6\frac{2}{3} \\ \underline{\frac{1}{3}} \end{array}$	$\begin{array}{r} 10\frac{3}{16} \\ \underline{10} \end{array}$	$\begin{array}{r} 11\frac{4}{5} \\ \underline{\frac{1}{5}} \end{array}$	$\begin{array}{r} 16\frac{7}{10} \\ \underline{12} \end{array}$	

3.	$\begin{array}{r} 5\frac{13}{16} \\ \underline{\frac{11}{16}} \end{array}$	$\begin{array}{r} 7\frac{2}{3} \\ \underline{3} \end{array}$	$\begin{array}{r} 4\frac{7}{8} \\ \underline{1} \end{array}$	$\begin{array}{r} \frac{7}{12} \\ \underline{\frac{5}{12}} \end{array}$	$\begin{array}{r} 6\frac{1}{4} \\ \underline{\frac{1}{4}} \end{array}$	$\begin{array}{r} 2\frac{9}{10} \\ \underline{1\frac{3}{10}} \end{array}$

Answers

1.	0	$\frac{1}{4}$	$\frac{2}{3}$	$\frac{1}{2}$	$\frac{1}{3}$	$\frac{3}{5}$	0
2.	$3\frac{5}{6}$	$9\frac{1}{2}$	$6\frac{1}{3}$	$\frac{3}{16}$	$11\frac{3}{5}$	$4\frac{7}{10}$	
3.	$5\frac{1}{8}$	$4\frac{2}{3}$	$3\frac{7}{8}$	$\frac{1}{6}$	6	$1\frac{3}{5}$	

Self-Help 20

D	E	F
$\begin{array}{rcr} \frac{1}{2} & = & \frac{4}{8} \\ \underline{\frac{1}{8}} & = & \underline{\frac{1}{8}} \\ & & \frac{3}{8} \end{array}$	$\begin{array}{rcr} 5\frac{4}{5} & = & 5\frac{8}{10} \\ \underline{\frac{1}{2}} & = & \underline{\frac{5}{10}} \\ & & 5\frac{3}{10} \end{array}$	$\begin{array}{rcr} 8\frac{4}{5} & = & 8\frac{12}{15} \\ \underline{3\frac{2}{3}} & = & \underline{3\frac{10}{15}} \\ & & 5\frac{2}{15} \end{array}$

Look at Example D above. The fractions have different denominators; so before you subtract, you should change $\frac{1}{2}$ to eighths. If you have forgotten how to do this, study section D on page 435. $\frac{1}{2}=\frac{?}{8}$.

Now subtract. Is $\frac{3}{8}$ the correct answer?

In Example E the denominator to use is the smallest number that can be divided exactly by both 5 and 2. To find this number, try 2 times the larger denominator. $2\times5=10$. Why is 10 the denominator to use? Change $\frac{4}{5}$ and $\frac{1}{2}$ to tenths. Then subtract. $\frac{8}{10}-\frac{5}{10}=\frac{3}{10}$.

Since there is nothing to subtract from 5, write 5 in the answer. Is the answer in simplest form?

The work in Example F is like the work in Example E except that you must remember to subtract 3 from 8 in the whole-number column. Is $5\frac{2}{15}$ the correct answer?

Subtract in the examples below. Directions for copying and working examples are given on page 442.

1.	$\frac{3}{5}$	$\frac{1}{4}$	$\frac{1}{6}$	$\frac{5}{6}$	$\frac{1}{2}$	$\frac{5}{16}$	$\frac{9}{10}$
	$\underline{\frac{1}{10}}$	$\underline{\frac{1}{12}}$	$\underline{\frac{1}{8}}$	$\underline{\frac{2}{3}}$	$\underline{\frac{3}{10}}$	$\underline{\frac{1}{4}}$	$\underline{\frac{1}{4}}$
2.	$11\frac{1}{4}$	$5\frac{3}{4}$	$4\frac{3}{4}$	$10\frac{4}{5}$	$2\frac{2}{3}$	$9\frac{5}{6}$	
	$\underline{\frac{1}{16}}$	$\underline{\frac{1}{5}}$	$\underline{\frac{1}{3}}$	$\underline{\frac{2}{3}}$	$\underline{\frac{5}{8}}$	$\underline{\frac{1}{4}}$	
3.	$8\frac{5}{6}$	$9\frac{13}{16}$	$5\frac{3}{8}$	$3\frac{1}{2}$	$8\frac{3}{4}$	$4\frac{3}{4}$	
	$\underline{2\frac{3}{4}}$	$\underline{3\frac{3}{8}}$	$\underline{3\frac{1}{6}}$	$\underline{1\frac{1}{6}}$	$\underline{6\frac{1}{10}}$	$\underline{3\frac{1}{12}}$	

Answers

1.	$\frac{1}{2}$	$\frac{1}{6}$	$\frac{1}{24}$	$\frac{1}{6}$	$\frac{1}{5}$	$\frac{1}{16}$	$\frac{13}{20}$
2.	$11\frac{3}{16}$	$5\frac{11}{20}$	$4\frac{5}{12}$	$10\frac{2}{15}$	$2\frac{1}{24}$	$9\frac{7}{12}$	
3.	$6\frac{1}{12}$	$6\frac{7}{16}$	$2\frac{5}{24}$	$2\frac{1}{3}$	$2\frac{13}{20}$	$1\frac{2}{3}$	

Self-Help 21

Look at Example G. To subtract $\frac{2}{3}$ from 9, write $\frac{2}{3}$ in a separate column. There is no fraction from which to subtract $\frac{2}{3}$; so change 9 to $8\frac{3}{3}$. Now subtract in the fraction column.

How do you get the 8 in the answer? Is $8\frac{1}{3}$ the correct answer?

G

$$\begin{array}{rcr} 9 & = & 8\frac{3}{3} \\ \underline{\frac{2}{3}} & = & \underline{\frac{2}{3}} \\ & & 8\frac{1}{3} \end{array}$$

To subtract in Example H, change 6 to $5\frac{5}{5}$. Subtract first in the fraction column. $\frac{5}{5}-\frac{2}{5}=\frac{3}{5}$.

Then subtract in the whole-number column. $5-5=0$. $\frac{3}{5}$ is the answer.

H

$$\begin{array}{rcr} 6 & = & 5\frac{5}{5} \\ \underline{5\frac{2}{5}} & = & \underline{5\frac{2}{5}} \\ & & \frac{3}{5} \end{array}$$

Subtract in the examples below. Directions for copying and working examples are given on page 442.

1.	1	12	4	9	2	6
	$\frac{3}{10}$	$\frac{1}{5}$	$\frac{1}{2}$	$\frac{1}{16}$	$\frac{3}{8}$	$\frac{1}{3}$
2.	7	10	8	7	9	5
	$3\frac{1}{4}$	$8\frac{5}{8}$	$5\frac{2}{5}$	$4\frac{3}{10}$	$5\frac{1}{3}$	$1\frac{1}{6}$
3.	3	9	5	6	8	7
	$2\frac{1}{10}$	$4\frac{2}{3}$	$\frac{1}{2}$	$4\frac{7}{12}$	$3\frac{5}{6}$	$\frac{7}{8}$

Answers

1.	$\frac{7}{10}$	$11\frac{4}{5}$	$3\frac{1}{2}$	$8\frac{15}{16}$	$1\frac{5}{8}$	$5\frac{2}{3}$
2.	$3\frac{3}{4}$	$1\frac{3}{8}$	$2\frac{3}{5}$	$2\frac{7}{10}$	$3\frac{2}{3}$	$3\frac{5}{6}$
3.	$\frac{9}{10}$	$4\frac{1}{3}$	$4\frac{1}{2}$	$1\frac{5}{12}$	$4\frac{1}{6}$	$6\frac{1}{8}$

Self-Help 22

I

$$\begin{array}{ccccc} & & \text{Step 1} & & \text{Step 2} \\ 7\frac{7}{12} & = & 7\frac{7}{12} & = & 6\frac{19}{12} \\ \underline{\frac{2}{3}} & = & \underline{\frac{8}{12}} & = & \underline{\frac{8}{12}} \\ & & & & 6\frac{11}{12} \end{array}$$

In Example I the fractions have different denominators. Which fraction do you change? Can you subtract $\frac{8}{12}$ from $\frac{7}{12}$?

Look at Step 2. To change $7\frac{7}{12}$ to $6\frac{19}{12}$, think, "$7=6\frac{12}{12}$. $7\frac{7}{12}=6\frac{12}{12}+\frac{7}{12}=6\frac{19}{12}$."

Now subtract in the fraction column. $\frac{19}{12}-\frac{8}{12}=\frac{11}{12}$. How do you get the 6 in the answer? Is the answer in simplest form?

Now study Example J at the top of the next page. Is the work different from the work in Example I?

How do you find the denominator to use in Example J?

Look at Step 1. You cannot subtract $\frac{12}{20}$ from $\frac{5}{20}$. Why?

In Step 2, how do you change $14\frac{5}{20}$ to $13\frac{25}{20}$?

Subtract in the fraction column. $\frac{25}{20}-\frac{12}{20}=\frac{13}{20}$.

J

$$\begin{array}{rcrcr} & & \text{Step 1} & & \text{Step 2} \\ 14\frac{1}{4} & = & 14\frac{5}{20} & = & 13\frac{25}{20} \\ \underline{2\frac{3}{5}} & = & \underline{2\frac{12}{20}} & = & \underline{2\frac{12}{20}} \\ & & & & 11\frac{13}{20} \end{array}$$

Subtract in the whole-number column. $13-2=11$. Is the answer in simplest form?

Copy the examples below, close your book, and subtract. Be sure your answers are in simplest form. Compare your answers with the correct answers at the end of this Self-Help. Correct any mistakes you may have made.

1.	$\begin{array}{r} 2\frac{1}{4} \\ \frac{4}{5} \\ \hline \end{array}$	$\begin{array}{r} 13\frac{1}{6} \\ \frac{5}{8} \\ \hline \end{array}$	$\begin{array}{r} 5\frac{5}{16} \\ \frac{13}{16} \\ \hline \end{array}$	$\begin{array}{r} 10\frac{2}{5} \\ \frac{1}{2} \\ \hline \end{array}$	$\begin{array}{r} 3\frac{1}{4} \\ \frac{1}{3} \\ \hline \end{array}$	$\begin{array}{r} 7\frac{1}{4} \\ \frac{3}{4} \\ \hline \end{array}$
2.	$\begin{array}{r} 8\frac{3}{8} \\ 4\frac{2}{3} \\ \hline \end{array}$	$\begin{array}{r} 11\frac{1}{10} \\ 9\frac{7}{10} \\ \hline \end{array}$	$\begin{array}{r} 9\frac{1}{8} \\ 6\frac{5}{6} \\ \hline \end{array}$	$\begin{array}{r} 8\frac{2}{10} \\ 5\frac{3}{4} \\ \hline \end{array}$	$\begin{array}{r} 10\frac{1}{2} \\ 6\frac{2}{3} \\ \hline \end{array}$	$\begin{array}{r} 6\frac{3}{5} \\ 2\frac{3}{4} \\ \hline \end{array}$
3.	$\begin{array}{r} 4\frac{1}{4} \\ 3\frac{5}{6} \\ \hline \end{array}$	$\begin{array}{r} 10\frac{1}{5} \\ \frac{2}{3} \\ \hline \end{array}$	$\begin{array}{r} 6\frac{1}{4} \\ \frac{5}{12} \\ \hline \end{array}$	$\begin{array}{r} 7\frac{3}{16} \\ 5\frac{11}{16} \\ \hline \end{array}$	$\begin{array}{r} 9\frac{3}{5} \\ 4\frac{9}{10} \\ \hline \end{array}$	$\begin{array}{r} 8\frac{5}{12} \\ \frac{7}{12} \\ \hline \end{array}$

Answers

1.	$1\frac{9}{20}$	$12\frac{13}{24}$	$4\frac{1}{2}$	$9\frac{9}{10}$	$2\frac{11}{12}$	$6\frac{1}{2}$
2.	$3\frac{17}{24}$	$1\frac{2}{5}$	$2\frac{7}{24}$	$2\frac{9}{20}$	$3\frac{5}{6}$	$3\frac{17}{20}$
3.	$\frac{5}{12}$	$9\frac{8}{15}$	$5\frac{5}{6}$	$1\frac{1}{2}$	$4\frac{7}{10}$	$7\frac{5}{6}$

Self-Help Tests in Multiplication of Fractions

Multiply in the tests below. Be sure that your answers are in simplest form. If you have forgotten how to change fractions, study sections A, B, and E in Self-Help 14 on pages 434 to 436.

Test 23	$\frac{1}{2}\times\frac{1}{2}$	$\frac{1}{2}\times\frac{5}{6}$	$8\times\frac{1}{3}$	$\frac{2}{3}\times\frac{1}{5}$
Test 24	$\frac{1}{2}\times\frac{2}{3}$	$\frac{4}{5}\times\frac{1}{6}$	$3\times\frac{5}{6}$	$\frac{9}{10}\times10$
Test 25	$\frac{2}{3}\times\frac{3}{10}$	$\frac{2}{5}\times\frac{5}{8}$	$\frac{5}{6}\times\frac{9}{10}$	$\frac{9}{10}\times\frac{5}{12}$
Test 26	$\frac{1}{2}\times4\frac{1}{8}$	$3\frac{1}{5}\times1\frac{5}{6}$	$12\times1\frac{11}{12}$	$5\frac{2}{3}\times3\frac{1}{2}$

If you made a mistake in any test above, do the Self-Help with the same number as the test.

Self-Help Practice in Multiplication of Fractions

Self-Help 23

A

$$\frac{1}{3}\times\frac{5}{6}=\frac{5}{18}$$

B

$$7\times\frac{3}{5}=\frac{21}{5}=4\frac{1}{5}$$

To work Example A, first multiply the numerators. $1\times5=5$. Write 5 as the numerator of the answer.

Next multiply the denominators. $3\times6=18$. Write 18 as the denominator of the answer.

Is the answer in simplest form?

In Example B think of the 7 as $\frac{7}{1}$. Do not write the 1. Now multiply the numerators. $7\times3=21$. Multiply the denominators. $1\times5=5$.

How do you change $\frac{21}{5}$ to $4\frac{1}{5}$?

Go on to the next page.

Copy the examples below, close your book, and multiply. Be sure that your answers are in simplest form. Compare your answers with the correct answers given below. Work again any examples you had wrong.

1.	$\frac{1}{2}\times\frac{1}{3}$	$\frac{3}{8}\times\frac{1}{4}$	$\frac{1}{3}\times\frac{1}{8}$	$\frac{3}{4}\times\frac{3}{5}$	$\frac{2}{3}\times\frac{2}{5}$
2.	$\frac{9}{10}\times 3$	$5\times\frac{7}{8}$	$7\times\frac{1}{6}$	$\frac{3}{5}\times 4$	$7\times\frac{1}{4}$
3.	$3\times\frac{1}{5}$	$\frac{1}{3}\times\frac{1}{3}$	$\frac{3}{4}\times\frac{5}{8}$	$4\times\frac{2}{3}$	$\frac{1}{6}\times\frac{1}{6}$
4.	$\frac{1}{2}\times\frac{1}{4}$	$\frac{1}{6}\times\frac{1}{3}$	$9\times\frac{1}{2}$	$\frac{7}{12}\times 5$	$3\times\frac{7}{8}$

Answers

1. $\frac{1}{6}, \frac{3}{32}, \frac{1}{24}, \frac{9}{20}, \frac{4}{15}$

2. $2\frac{7}{10}, 4\frac{3}{8}, 1\frac{1}{6}, 2\frac{2}{5}, 1\frac{3}{4}$

3. $\frac{3}{5}, \frac{1}{9}, \frac{15}{32}, 2\frac{2}{3}, \frac{1}{36}$

4. $\frac{1}{8}, \frac{1}{18}, 4\frac{1}{2}, 2\frac{11}{12}, 2\frac{5}{8}$

Self-Help 24

C

$$\frac{\overset{1}{\cancel{3}}}{4}\times\frac{1}{\underset{4}{\cancel{12}}}=\frac{1}{16}$$

D

$$\frac{7}{\underset{4}{\cancel{8}}}\times\overset{5}{\cancel{10}}=\frac{35}{4}=8\frac{3}{4}$$

Example C shows a short cut in multiplying fractions. If the numerator of one fraction and the denominator of the other can be divided exactly by the same number, you can *cancel*. Both the 3 and the 12 can be divided by 3. Cross out 3 and write 1 above it. Why do you write 4 below the 12?

Now multiply the numerators. $1\times 1=1$. Multiply the denominators. $4\times 4=16$. Is $\frac{1}{16}$ in simplest form?

Can you cancel in Example D above? By what number do you divide 8 and 10? How do you get $\frac{35}{4}$?

Why do you change $\frac{35}{4}$ to $8\frac{3}{4}$?

Multiply in the examples at the top of the next page.

1.	$\frac{1}{2}\times\frac{2}{3}$	$\frac{1}{12}\times\frac{3}{16}$	$\frac{1}{3}\times\frac{3}{5}$	$\frac{5}{10}\times\frac{5}{12}$	$\frac{2}{3}\times\frac{1}{4}$
2.	$\frac{2}{3}\times 15$	$9\times\frac{1}{6}$	$\frac{1}{6}\times\frac{9}{10}$	$\frac{1}{10}\times 15$	$\frac{7}{12}\times 9$
3.	$\frac{4}{5}\times\frac{1}{10}$	$\frac{1}{12}\times\frac{9}{16}$	$4\times\frac{3}{4}$	$\frac{11}{12}\times 3$	$8\times\frac{9}{10}$
4.	$\frac{5}{6}\times 9$	$10\times\frac{3}{5}$	$\frac{4}{5}\times\frac{1}{6}$	$6\times\frac{2}{3}$	$\frac{5}{8}\times 4$

Answers

1. $\frac{1}{3}, \frac{1}{64}, \frac{1}{5}, \frac{5}{24}, \frac{1}{6}$ **2.** $10, 1\frac{1}{2}, \frac{3}{20}, 1\frac{1}{2}, 5\frac{1}{4}$

3. $\frac{2}{25}, \frac{3}{64}, 3, 2\frac{3}{4}, 7\frac{1}{5}$ **4.** $7\frac{1}{2}, 6, \frac{2}{15}, 4, 2\frac{1}{2}$

Self-Help 25

E

$$\frac{\overset{1}{\cancel{4}}}{\underset{1}{\cancel{5}}} \times \frac{\overset{1}{\cancel{5}}}{\underset{2}{\cancel{8}}} = \frac{1}{2}$$

In Example E you can cancel twice. You divide the 4 and the 8 by __. You divide the 5 in $\frac{4}{5}$ and the 5 in $\frac{5}{8}$ by __.

Now multiply the numerators. $1\times 1=1$. Multiply the denominators. $1\times 2=2$.

$\frac{1}{2}$ is the correct answer. Is it in simplest form?

Multiply in the examples below. Be sure to cancel wherever possible. Follow the directions at the top of page 448 for copying and working examples.

1.	$\frac{4}{5}\times\frac{5}{6}$	$\frac{2}{3}\times\frac{15}{16}$	$\frac{5}{6}\times\frac{9}{10}$	$\frac{3}{8}\times\frac{2}{3}$	$\frac{5}{16}\times\frac{4}{5}$
2.	$\frac{5}{12}\times\frac{9}{10}$	$\frac{3}{10}\times\frac{5}{12}$	$\frac{2}{5}\times\frac{5}{6}$	$\frac{5}{12}\times\frac{4}{5}$	$\frac{3}{4}\times\frac{2}{3}$
3.	$\frac{3}{5}\times\frac{5}{6}$	$\frac{9}{16}\times\frac{2}{3}$	$\frac{5}{12}\times\frac{3}{5}$	$\frac{2}{5}\times\frac{15}{16}$	$\frac{2}{3}\times\frac{3}{10}$
4.	$\frac{2}{3}\times\frac{3}{16}$	$\frac{2}{5}\times\frac{5}{8}$	$\frac{4}{5}\times\frac{15}{16}$	$\frac{9}{10}\times\frac{5}{12}$	$\frac{3}{5}\times\frac{5}{12}$

Answers

1. $\frac{2}{3}, \frac{5}{8}, \frac{3}{4}, \frac{1}{4}, \frac{1}{4}$ **2.** $\frac{3}{8}, \frac{1}{8}, \frac{1}{3}, \frac{1}{3}, \frac{1}{2}$

3. $\frac{1}{2}, \frac{3}{8}, \frac{1}{4}, \frac{3}{8}, \frac{1}{5}$ **4.** $\frac{1}{8}, \frac{1}{4}, \frac{3}{4}, \frac{3}{8}, \frac{1}{4}$

Self-Help 26

To multiply $\frac{3}{4}$ by $4\frac{2}{3}$, you should first change $4\frac{2}{3}$ to an improper fraction. If you have forgotten how to do this, study section E of Self-Help 14 on page 436.

F

$$4\frac{2}{3} \times \frac{3}{4} = \frac{\overset{7}{\cancel{14}}}{\underset{1}{\cancel{3}}} \times \frac{\overset{1}{\cancel{3}}}{\underset{2}{\cancel{4}}} = \frac{7}{2} = 3\frac{1}{2}$$

$4\frac{2}{3}=\frac{14}{3}$. Is the canceling in Example F correct? How do you get $\frac{7}{2}$? Why do you change $\frac{7}{2}$ to $3\frac{1}{2}$?

G	H
$8 \times 3\frac{1}{10} = \overset{4}{\cancel{8}} \times \frac{31}{\underset{5}{\cancel{10}}} = \frac{124}{5} = 24\frac{4}{5}$	$3\frac{1}{5} \times 2\frac{1}{2} = \frac{\overset{8}{\cancel{16}}}{\underset{1}{\cancel{5}}} \times \frac{\overset{1}{\cancel{5}}}{\underset{1}{\cancel{2}}} = \frac{8}{1} = 8$

In Example G above, change $3\frac{1}{10}$ to $\frac{?}{10}$ before you multiply. Why is 4 written above 8 and 5 written below 10? How do you get $\frac{124}{5}$? How do you get $24\frac{4}{5}$?

Look at Example H. $3\frac{1}{5}$ and $2\frac{1}{2}$ are changed to the improper fractions __ and __. Is the canceling correct? What is the answer for Example H?

Multiply in the examples below. Follow the directions on page 448 for copying and working examples.

1.	$1\frac{1}{5}\times\frac{7}{10}$	$\frac{15}{16}\times1\frac{3}{5}$	$\frac{2}{3}\times6\frac{3}{4}$	$8\frac{4}{5}\times\frac{15}{16}$
2.	$2\times1\frac{1}{4}$	$8\times1\frac{1}{10}$	$1\frac{1}{8}\times\frac{2}{3}$	$4\frac{1}{5}\times2$
3.	$2\frac{5}{8}\times3\frac{1}{3}$	$3\frac{3}{4}\times2\frac{1}{5}$	$2\frac{1}{12}\times1\frac{1}{5}$	$2\frac{2}{5}\times1\frac{7}{8}$
4.	$3\frac{1}{3}\times1\frac{3}{10}$	$4\times2\frac{1}{6}$	$\frac{4}{5}\times1\frac{1}{10}$	$\frac{3}{8}\times3\frac{1}{3}$

Answers

1. $\frac{21}{25}$, $1\frac{1}{2}$, $4\frac{1}{2}$, $8\frac{1}{4}$ **2.** $2\frac{1}{2}$, $8\frac{4}{5}$, $\frac{3}{4}$, $8\frac{2}{5}$

3. $8\frac{3}{4}$, $8\frac{1}{4}$, $2\frac{1}{2}$, $4\frac{1}{2}$ **4.** $4\frac{1}{3}$, $8\frac{2}{3}$, $\frac{22}{25}$, $1\frac{1}{4}$

Self-Help Tests in Division of Fractions

Divide in each test below. Be sure that your answers are in simplest form.

Test 27	$\frac{1}{2} \div \frac{3}{4}$	$\frac{2}{3} \div \frac{1}{2}$	$9 \div \frac{1}{6}$	$\frac{1}{4} \div \frac{1}{6}$
Test 28	$3\frac{1}{6} \div \frac{2}{3}$	$\frac{3}{4} \div 1\frac{5}{6}$	$2\frac{1}{5} \div \frac{3}{5}$	$\frac{1}{2} \div 1\frac{7}{8}$
Test 29	$2\frac{1}{4} \div 9$	$\frac{3}{5} \div 2$	$\frac{2}{3} \div 7$	$4\frac{2}{3} \div 4$
Test 30	$1\frac{1}{2} \div 1\frac{1}{3}$	$3 \div 5\frac{2}{5}$	$2\frac{1}{4} \div 1\frac{1}{6}$	$10 \div 1\frac{7}{8}$

If you made a mistake in any of the tests above, do the Self-Help with the same number as the test.

Self-Help Practice in Division of Fractions

Self-Help 27

A	B
$\frac{1}{3} \div \frac{1}{2} = \frac{1}{3} \times \frac{2}{1} = \frac{2}{3}$	$8 \div \frac{1}{4} = 8 \times \frac{4}{1} = \frac{32}{1} = 32$

Look at Example A above. To divide, you should first rewrite the example with two changes:

1. *Invert the divisor $\frac{1}{2}$ so that it becomes $\frac{2}{1}$.*
2. *Change the division sign to a multiplication sign.*

Now you have the example $\frac{1}{3} \times \frac{2}{1}$. Multiply. Is $\frac{2}{3}$ the correct answer?

What is the divisor in Example B? What two changes do you make when you rewrite the example?

Think of the 8 as $\frac{8}{1}$ when you multiply. How do you get $\frac{32}{1}$? Write $\frac{32}{1}$ as 32.

Copy the examples at the top of the next page, close your book, and divide. Correct any mistakes you make.

1. $\frac{3}{16} \div \frac{1}{5}$ $\quad \frac{3}{5} \div \frac{1}{2}$ $\quad \frac{1}{8} \div \frac{1}{5}$ $\quad \frac{3}{4} \div \frac{1}{3}$ $\quad \frac{5}{16} \div \frac{1}{3}$

2. $6 \div \frac{2}{3}$ $\quad 12 \div \frac{3}{4}$ $\quad 4 \div \frac{1}{5}$ $\quad 2 \div \frac{2}{5}$ $\quad 5 \div \frac{5}{6}$

3. $\frac{3}{10} \div \frac{1}{4}$ $\quad \frac{15}{16} \div \frac{3}{4}$ $\quad 3 \div \frac{15}{16}$ $\quad \frac{3}{10} \div \frac{3}{4}$ $\quad 6 \div \frac{3}{4}$

4. $9 \div \frac{3}{5}$ $\quad \frac{4}{5} \div \frac{2}{5}$ $\quad \frac{3}{8} \div \frac{3}{4}$ $\quad \frac{9}{10} \div \frac{3}{4}$ $\quad \frac{5}{6} \div \frac{5}{8}$

Answers

1. $\frac{15}{16}$, $1\frac{1}{5}$, $\frac{5}{8}$, $2\frac{1}{4}$, $\frac{15}{16}$
2. 9, 16, 20, 5, 6
3. $1\frac{1}{5}$, $1\frac{1}{4}$, $3\frac{1}{5}$, $\frac{2}{5}$, 8
4. 15, 2, $\frac{1}{2}$, $1\frac{1}{5}$, $1\frac{1}{3}$

Self-Help 28

C	D
$5\frac{1}{6} \div \frac{1}{3} = \frac{31}{\underset{2}{\cancel{6}}} \times \frac{\overset{1}{\cancel{3}}}{1} = \frac{31}{2} = 15\frac{1}{2}$	$\frac{5}{6} \div 1\frac{7}{8} = \frac{5}{6} \div \frac{15}{8} = \frac{\overset{1}{\cancel{5}}}{\underset{3}{\cancel{6}}} \times \frac{\overset{4}{\cancel{8}}}{\underset{3}{\cancel{15}}} = \frac{4}{9}$

Look at Example C above. Notice that it is rewritten with three changes. First $5\frac{1}{6}$ is changed to $\frac{31}{6}$. If you have forgotten how this is done, study section E of Self-Help 14, page 436. What other two changes are made?

What canceling is done? How do you get $\frac{31}{2}$? Why is $\frac{31}{2}$ changed to $15\frac{1}{2}$?

In Example D, what is the divisor? Why is it changed to $\frac{15}{8}$? What two changes are made then?

Be prepared to explain the canceling. Is the answer correct and in simplest form?

Divide in the examples below. Follow directions for copying and working examples on page 451.

1. $4\frac{1}{2} \div \frac{1}{2}$ $\quad 1\frac{3}{8} \div \frac{15}{16}$ $\quad 1\frac{1}{8} \div \frac{3}{4}$ $\quad 2\frac{5}{8} \div \frac{7}{12}$ $\quad 6\frac{3}{4} \div \frac{3}{4}$

2. $\frac{3}{10} \div 2\frac{1}{10}$ $\quad \frac{9}{16} \div 2\frac{1}{10}$ $\quad \frac{3}{8} \div 2\frac{1}{16}$ $\quad \frac{5}{6} \div 1\frac{1}{4}$ $\quad \frac{7}{12} \div 4\frac{1}{12}$

3. $4\frac{9}{10} \div \frac{1}{5}$ $\quad 3\frac{1}{8} \div \frac{5}{12}$ $\quad \frac{1}{8} \div 5\frac{1}{4}$ $\quad \frac{15}{16} \div 1\frac{11}{16}$ $\quad \frac{1}{2} \div 1\frac{1}{3}$

4. $\frac{2}{3} \div 1\frac{1}{3}$ $\quad 3\frac{3}{8} \div \frac{3}{10}$ $\quad 1\frac{7}{10} \div \frac{3}{4}$ $\quad \frac{1}{4} \div 1\frac{1}{6}$ $\quad \frac{5}{6} \div 1\frac{5}{8}$

Answers

1. $9,\ 1\frac{7}{15},\ 1\frac{1}{2},\ 4\frac{1}{2},\ 9$
2. $\frac{1}{7},\ \frac{15}{56},\ \frac{2}{11},\ \frac{2}{3},\ \frac{1}{7}$
3. $24\frac{1}{2},\ 7\frac{1}{2},\ \frac{1}{42},\ \frac{5}{9},\ \frac{3}{8}$
4. $\frac{1}{2},\ 11\frac{1}{4},\ 2\frac{4}{15},\ \frac{3}{14},\ \frac{20}{39}$

Self-Help 29

E	F
$\frac{1}{2} \div 3 = \frac{1}{2} \times \frac{1}{3} = \frac{1}{6}$	$1\frac{1}{3} \div 2 = \frac{\overset{2}{\cancel{4}}}{3} \times \frac{1}{\underset{1}{\cancel{2}}} = \frac{2}{3}$

In Example E above, think of the divisor 3 as $\frac{3}{1}$. Now rewrite the example, changing the division sign and inverting the divisor.

How do you get $\frac{1}{6}$? Is it the correct answer?

In Example F why is $1\frac{1}{3}$ changed to $\frac{4}{3}$?

Think of the divisor 2 as $\frac{2}{1}$. What two changes do you make now when you rewrite the example?

Why is 2 written above 4 and 1 written below 2?

Is the answer correct and in simplest form?

Copy the examples below, close your book, and divide. Then correct any mistakes you may have made.

1. $\frac{1}{4} \div 3$ $\quad \frac{4}{5} \div 6$ $\quad \frac{5}{8} \div 10$ $\quad \frac{2}{3} \div 4$ $\quad \frac{3}{4} \div 3$
2. $2\frac{2}{5} \div 16$ $\quad 4\frac{2}{3} \div 2$ $\quad 4\frac{7}{12} \div 11$ $\quad 8\frac{1}{8} \div 5$ $\quad 4\frac{4}{5} \div 10$
3. $\frac{4}{5} \div 14$ $\quad 3\frac{1}{2} \div 7$ $\quad \frac{9}{10} \div 6$ $\quad 5\frac{5}{6} \div 15$ $\quad \frac{3}{4} \div 9$

Answers

1. $\frac{1}{12},\ \frac{2}{15},\ \frac{1}{16},\ \frac{1}{6},\ \frac{1}{4}$
2. $\frac{3}{20},\ 2\frac{1}{3},\ \frac{5}{12},\ 1\frac{5}{8},\ \frac{12}{25}$
3. $\frac{2}{35},\ \frac{1}{2},\ \frac{3}{20},\ \frac{7}{18},\ \frac{1}{12}$

Self-Help 30

G	H
$1\frac{4}{5} \div 2\frac{2}{5} = \frac{9}{5} \div \frac{12}{5} = \frac{\overset{3}{\cancel{9}}}{\underset{1}{\cancel{5}}} \times \frac{\overset{1}{\cancel{5}}}{\underset{4}{\cancel{12}}} = \frac{3}{4}$	$3 \div 3\frac{1}{2} = 3 \div \frac{7}{2} = 3 \times \frac{2}{7} = \frac{6}{7}$

In Example G above, both $1\frac{4}{5}$ and $2\frac{2}{5}$ are changed to improper fractions. What changes are made next?

How do you get $\frac{3}{4}$? Is $\frac{3}{4}$ the correct answer?

In Example H, $3\frac{1}{2}$ is changed to __. Then the __ sign is changed, and the divisor is __.

What canceling is done? Is $\frac{6}{7}$ the correct answer?

Copy the examples below, close your book, and divide. Correct any mistakes you may have made.

1.	$2\frac{7}{10} \div 3\frac{3}{5}$	$3\frac{3}{8} \div 6\frac{3}{4}$	$8\frac{3}{4} \div 1\frac{1}{6}$	$4\frac{7}{12} \div 4\frac{1}{8}$
2.	$2 \div 1\frac{1}{3}$	$9 \div 4\frac{1}{5}$	$10 \div 2\frac{2}{5}$	$3 \div 2\frac{7}{10}$
3.	$3\frac{1}{3} \div 4\frac{2}{3}$	$4 \div 6\frac{2}{3}$	$1\frac{7}{8} \div 6\frac{3}{4}$	$8 \div 4\frac{2}{3}$
4.	$11 \div 5\frac{3}{5}$	$5\frac{1}{4} \div 8\frac{2}{5}$	$8\frac{1}{4} \div 1\frac{5}{6}$	$7 \div 2\frac{1}{10}$

Answers

1. $\frac{3}{4}$, $\frac{1}{2}$, $7\frac{1}{2}$, $1\frac{1}{9}$ **2.** $1\frac{1}{2}$, $2\frac{1}{7}$, $4\frac{1}{6}$, $1\frac{1}{9}$

3. $\frac{5}{7}$, $\frac{3}{5}$, $\frac{5}{18}$, $1\frac{5}{7}$ **4.** $1\frac{27}{28}$, $\frac{5}{8}$, $4\frac{1}{2}$, $3\frac{1}{3}$

Self-Help Tests in Decimals

Multiply in each test below and at the top of the next page. If you make a mistake in any test, do the Self-Help with the same number as the test.

Test	3	.26	1.5	36	27	.35
32	.3	3	6	1.8	.17	7

Test 33	.6	3.6	8.3	.141	5.6	3.72
	.9	2.3	.6	1.4	.8	2.1

Test 34	.2	35	.0017	1.5	.7	.018
	.4	.0012	3.8	.003	.005	2.9

Divide in each test below. In Tests 36, 37, and 38, the answer may not come out exactly in tenths or hundredths. Find the answer to the nearest thousandth, if necessary.

Test 35	$61\overline{)158.6}$	$8\overline{).4368}$	$7\overline{).742}$	$33\overline{)13.86}$
Test 36	$56\overline{)75.2}$	$67\overline{)9.4}$	$5\overline{).33}$	$22\overline{)33}$
Test 37	$.13\overline{).91}$	$5.2\overline{)3.7}$	$31.7\overline{)2.219}$	$5.02\overline{).35491}$
Test 38	$.14\overline{)66}$	$.024\overline{).12}$	$1.59\overline{).9}$	$1.5\overline{)6}$

If you made a mistake in any test above, do the Self-Help with the same number as the test.

Self-Help Practice in Decimals

Self-Help 31

Example A shows how to add decimals. Notice that the decimal points are written in a column. The decimal point in the answer is directly under the others.

The answer is read *five and one thousand two hundred eighteen ten-thousandths.*

A
1.2576
.0023
3.8619
5.1218

Go on to the next page.

Example B shows you how to subtract decimals. The decimal points are written in a column, as in addition.

B

$$\begin{array}{r} 9.732 \\ 9.667 \\ \hline .065 \end{array}$$

Is the subtraction correct? 0 is put in the answer to show that the answer is sixty-five *thousandths*, not sixty-five *hundredths*.

Copy and work the examples below. Be careful to put decimal points in the answers. When you have finished, compare your answers with the answers at the end of the Self-Help. Correct any mistakes.

1.	82.5+4.6	.98+.02+.33		\$.46+\$.66
2.	.1597+.6988	.345+.360+.070		.7+.5+.4
3.	.1966+.6685+.2620+.4803			3.60+.96+4.56
4.	1.37−.86	\$9.30−\$7.54	4.0−3.8	1.50−.75
5.	5.240−2.398	5.6265−4.8290		\$1.31−\$.58
6.	8.343−.390	1.38−.40		9.732−9.667

Answers

1. 87.1, 1.33, \$1.12
2. .8585, .775, 1.6
3. 1.6074, 9.12
4. .51, \$1.76, .2, .75
5. 2.842, .7975, \$.73
6. 7.953, .98, .065

Self-Help 32

In Example C multiply exactly as with whole numbers. Is the multiplication correct?

.115 has three decimal places. Begin at the right and point off three decimal places in the answer.

C

$$\begin{array}{r} .115 \\ 6 \\ \hline .69\cancel{0} \\ \text{or } .69 \end{array}$$

The answer is .690 or .69. Notice that you may cross off all zeros at the right of the decimal point if no figures come after the zeros.

To place the decimal point in the answer when you multiply a whole number and a decimal, begin at the right and point off as many places as there are in the decimal number.

Copy the examples below, close your book, and multiply. Then compare your answers with the answers at the end of the Self-Help. Correct any mistakes.

1.	3.4	2.5	7.61	.063	.63	.046
	8	4	42	401	47	3
2.	97	840	85	685	72	710
	1.7	.38	1.4	.171	.29	.605

Answers

1.	27.2	10	319.62	25.263	29.61	.138
2.	164.9	319.2	119	117.135	20.88	429.55

Self-Help 33

Look at Example D. Is the multiplication correct?

.375 has 3 decimal places. 2.4 has 1 decimal place. That makes a total of 4 decimal places. Begin at the right and point off 4 decimal places in the answer.

D

$$\begin{array}{r} .375 \\ 2.4 \\ \hline 1500 \\ 750 \\ \hline .9\cancel{0}\cancel{0}\cancel{0} \end{array}$$

When you multiply a decimal by a decimal, point off as many places in the answer as the total decimal places in both numbers.

Go on to the next page.

Do not cross off any zeros until you have pointed off the answer.

Multiply in the examples below. Follow the directions on page 457 for copying and working examples.

1.	2.9	2.4	.96	.625	.87	7.1
	.5	7.5	7.4	4.8	.46	.7
2.	12.5	4.91	1.25	.465	.23	2.5
	.24	8.32	1.6	6.2	1.7	.8
3.	62.5	.7	3.2	.425	.83	1.6
	.25	.3	2.5	32.2	6.8	.9

Answers

1.	1.45	18	7.104	3	.4002	4.97
2.	3	40.8512	2	2.883	.391	2
3.	15.625	.21	8	13.685	5.644	1.44

Self-Help 34

In Example E, first multiply by 3.

Why should you point off 4 places in the answer? There are only 3 figures in 609; so in order to point off 4 places, you must write 1 zero at the left of 609. The answer is read *six hundred nine ten-thousandths.*

E

$$\begin{array}{r} 2.03 \\ \underline{.03} \\ .0609 \end{array}$$

Multiply in the examples below. Follow the directions on page 457 for copying and working examples.

1.	.1	3.6	.23	.028	.12	.08
	.6	.24	.17	2.6	.25	.8
2.	3.2	2.4	4.8	43	1.9	15
	.006	.03	.009	.001	.03	.006

3.	.489	.0094	16	.0017	73	.02
	.2	8	.0007	9	.0006	.9

Answers

1. .06 .864 .0391 .0728 .03 .064

2. .0192 .072 .0432 .043 .057 .09

3. .0978 .0752 .0112 .0153 .0438 .018

Self-Help 35

F

$$\begin{array}{r} . \\ 81\overline{).567} \end{array}$$

$$\begin{array}{r} .007 \\ 81\overline{).567} \\ \underline{567} \end{array}$$

Before you divide in Example F, put a decimal point in the answer.

When the divisor is a whole number, put the decimal point in the answer exactly above the decimal point in the number to be divided.

Now divide 81 into 567. Is the 7 in the answer correct? Write zeros over the 5 and 6.

The answer is *seven thousandths.*

When you divide a decimal, put a 0 in the answer in each place at the right of the decimal point for which you do not have a figure like 1, 2, 3, 4, and so on.

Copy the examples below, close your book, and divide. Be sure to correct any mistakes you make.

1. $8\overline{).832}$ $17\overline{)1.071}$ $28\overline{).252}$ $18\overline{).612}$

2. $47\overline{)13.63}$ $58\overline{)1.044}$ $35\overline{)93.45}$ $73\overline{)50.297}$

3. $67\overline{)4.3081}$ $23\overline{)147.66}$ $7\overline{).735}$ $82\overline{)55.76}$

Answers

1. .104, .063, .009, .034 **2.** .29, .018, 2.67, .689

3. .0643, 6.42, .105, .68

Self-Help 36

G

$$\begin{array}{r} .073 \\ 23\overline{)1.700} \\ 1\,61 \\ \hline 90 \\ 69 \\ \hline 21 \end{array}$$

Example G shows how to find an answer to the nearest thousandth if it does not come out exactly in tenths or hundredths.

First put the decimal point in the answer. Then divide. 23 will not go into 17, so write 0 at the right of the 7 in 1.7. How many times will 23 go into 170?

Now write 0 between the 7 and the decimal point in the answer because the 7 means hundredths.

Write another 0 after 1.70 to find the answer to thousandths. Bring down this 0 and divide 90 by 23.

Now your answer is in thousandths. Look at the remainder, 21. It is more than $\frac{1}{2}$ of the divisor. The answer to the nearest thousandth is .074, not .073.

If the remainder had been 11, would the answer to the nearest thousandth have been .073 or .074?

H

$$\begin{array}{r} .428 \\ 21\overline{)9.000} \\ 8\,4 \\ \hline 60 \\ 42 \\ \hline 180 \\ 168 \\ \hline 12 \end{array}$$

Example H shows how to divide 9 by 21.

Put a decimal point at the right of 9 because 9 is a whole number.

You must write a 0 at the right of the decimal point before you can divide. Why do you write 2 more zeros?

Is the answer to the nearest thousandth .428 or .429? Why?

Copy the examples below, close your book, and divide. Find the answers to the nearest thousandth.

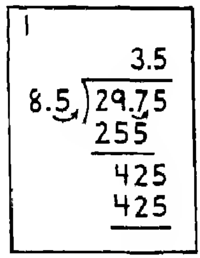
1.	$79\overline{)2.77}$	$51\overline{)472}$	$96\overline{).75}$	$76\overline{)25.9}$
2.	$25\overline{)2.08}$	$16\overline{).136}$	$77\overline{)53.2}$	$21\overline{)189.9}$

3. $90\overline{)33}$ $.78\overline{)132.7}$ $42\overline{)390.9}$ $14\overline{)1.05}$

Answers

1. .035, 9.255, .008, .341 **2.** .083, .009, .691, 9.043
3. .367, 1.701, 9.307, .075

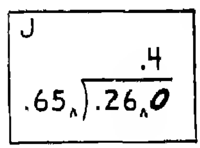
Self-Help 37



To divide in Example I, change the divisor, 8.5, to a whole number. The arrow shows that you do this by moving the decimal point one place to the right. Move the decimal point in 29.75 one place to the right also.

Now write the decimal point in the answer exactly above the place to which the arrow in 29.75 points. Divide. Is 3.5 the correct answer?

Whenever you move the decimal point in the divisor a certain number of places to the right, you must also move the decimal point in the number you are dividing the same number of places to the right.



In Example J carets were used instead of arrows to show how the decimal points were moved.

The carets show that the decimal points in .65 and .26 were moved __ places to the __.

Where do you write the decimal point in the answer?

Divide in the examples below and on the next page. Divide to the nearest thousandth if necessary.

1. $.29\overline{)1.74}$ $6.8\overline{)516.8}$ $.074\overline{).637}$ $1.28\overline{)4.48}$

2. $.039\overline{).702}$ $5.46\overline{).51}$ $.19\overline{)6.213}$ $.0072\overline{).4824}$

3. $6.2\overline{)570.4}$ $.36\overline{)6.05}$ $17.6\overline{)1.5312}$ $6.3\overline{)3.9}$

4. $.54\overline{).497}$ $.26\overline{)6.41}$ $.12\overline{).0128}$ $.709\overline{)14.606}$

Answers

1. 6, 76, 8.608, 3.5 **2.** 18, .093, 32.7, 67

3. 92, 16.806, .087, .619 **4.** .92, 24.654, .107, 20.601

Self-Help 38

K

$$\begin{array}{r} .02 \\ 11.25_{\wedge}\overline{).30_{\wedge}00} \end{array}$$

Example K shows how to work this example: $11.25\overline{).3.}$

Why do you move the decimal point in 11.25 two places to the right?

How many places must you move the decimal point in .3? Before you can move the decimal point two places to the right, you must write 0 at the right of .3.

Where do you write the decimal point in the answer?

Explain the 0 and the 2 in the answer. Finish the example. What is the answer to the nearest thousandth?

Divide in the examples below. Find the answers to the nearest thousandth if necessary.

1. $.0045\overline{).414}$ $7.1\overline{)49}$ $.65\overline{).5}$ $.87\overline{)67.9}$

2. $.48\overline{).3}$ $6.7\overline{)6}$ $9.7\overline{)24}$ $.78\overline{)15.5}$

3. $.38\overline{)19}$ $43.09\overline{)3.5}$ $.69\overline{)2.7}$ $1.04\overline{).9}$

4. $3.1\overline{)255}$ $.094\overline{).47}$ $8.6\overline{)534}$ $.52\overline{).4}$

Answers

1. 92, 6.901, .769, 78.046 **2.** .625, .896, 2.474, 19.872

3. 50, .081, 3.913, .865 **4.** 82.258, 5, 62.093, .769

Self-Help Tests in Measures

Add in the following examples.

Test	2 ft. 6 in.	5 min. 41 sec.	7 yd. 1 ft.
39	1 ft. 5 in.	3 min. 12 sec.	3 yd. 1 ft.

5 yr. 7 mo. + 6 yr. 6 mo.

4 lb. 15 oz. + 9 lb. 3 oz.

Subtract in the following examples.

Test	347 T. 1957 lb.	53 mi. 4952 ft.	9 wk. 4 da.
40	68 T. 1342 lb.	36 mi. 3476 ft.	6 da.

7 gal. 1 qt. − 5 gal. 2 qt.

26 lb. 9 oz. − 15 lb. 13 oz.

Multiply in the following examples.

Test	5 bu. 1 pk.	9 T. 156 lb.	17 yr. 2 mo.
41	2	8	4

7 × 3 lb. 12 oz. 10 × 5 hr. 12 min.

Divide in the following examples.

Test 42

344 rd. 16 ft. ÷ 8 1 min. 24 sec. ÷ 7

48 yr. 6 mo. ÷ 6 1 mi. 383 ft. ÷ 7

If you made a mistake in any of the above tests, do the Self-Help with the same number as the test. Self-Help 39 for Test 39 is on page 464.

Self-Help Practice in Measures

Self-Help 39

Look at Example A. Notice that the numbers for pounds and ounces are written in separate columns.

To add in Example A, first add the ounces. 6 oz.+14 oz.=20 oz. Write 20 oz.

Now add in the column for pounds. 3 lb.+11 lb.=14 lb. The sum is 14 lb. 20 oz. To change it to simplest form, think: 20 oz.=1 lb. 4 oz. 14 lb.+1 lb. 4 oz.=15 lb. 4 oz.

A

11 lb.	14 oz.
3 lb.	6 oz.
14 lb.	20 oz =
15 lb.	4 oz.

Copy the examples below, close your book, and add. Then compare your answers with the correct answers below. Work again any examples you had wrong.

1.	16 ft. 3 in. 34 ft. 8 in.	7 gal. 3 qt. 12 gal. 2 qt.	25 lb. 11 oz. 17 lb. 9 oz.
2.	9 hr. 5 hr. 41 min.	14 bu. 2 pk. 39 bu. 1 pk.	16 wk. 2 da. 12 wk. 6 da.
3.	506 yd. 2 ft. 439 yd. 226 yd. 2 ft.	14 yd. 2 ft. 23 yd. 1 ft. 71 yd. 2 ft.	17 gal. 3 qt. 9 gal. 2 qt. 13 gal. 2 qt.

Answers

1.	50 ft. 11 in.	20 gal. 1 qt.	43 lb. 4 oz.
2.	14 hr. 41 min.	53 bu. 3 pk.	29 wk. 1 da.
3.	1172 yd. 1 ft.	109 yd. 2 ft.	40 gal. 3 qt.

Self-Help 40

Example B shows how to subtract 30 ft. 5 in. from 40 ft. 2 in.

You cannot subtract 5 in. from 2 in; so take 1 ft. from 40 ft. and change it to inches. 1 ft. = 12 in. Add 12 in. to 2 in.

B

$$\begin{array}{r}
39\ \phantom{\text{ft.}}\ 14\phantom{\text{ in.}} \\
\cancel{40}\text{ ft. }\cancel{2}\text{ in.} \\
\underline{30\text{ ft. }5\text{ in.}} \\
9\text{ ft. }9\text{ in.}
\end{array}$$

Now subtract 30 ft. 5 in. from 39 ft. 14 in. Is the subtraction correct? Is the answer in simplest form? How do you know?

Subtract in the examples below. Compare your answers with the answers at the end of this Self-Help. Correct any mistakes you may have made.

1.	31 bu. 2 pk. 23 bu. 3 pk.	8 yr. 11 mo. 3 yr. 5 mo.	18 lb. 13 oz. 13 lb. 15 oz.
2.	25 yd. 2 ft. 16 yd. 1 ft.	7 hr. 19 min. 3 hr. 43 min.	44 gal. 3 qt. 35 gal. 1 qt.
3.	9 wk. 5 da. 6 wk. 6 da.	11 T. 556 lb. 8 T. 1794 lb.	54 rd. 9 ft. 17 rd. 2 ft.
4.	29 yr. 7 mo. 13 yr. 11 mo.	7 bu. 2 pk. 3 bu. 3 pk.	27 yd. 1 ft. 16 yd. 2 ft.

Answers

1.	7 bu. 3 pk.	5 yr. 6 mo.	4 lb. 14 oz.
2.	9 yd. 1 ft.	3 hr. 36 min.	9 gal. 2 qt.
3.	2 wk. 6 da.	2 T. 762 lb.	37 rd. 7 ft.
4.	15 yr. 8 mo.	3 bu. 3 pk.	10 yd. 2 ft.

Self-Help 41

C	
1 wk.	3 da.
	8
8 wk.	24 da. =
11 wk.	3 da.

Look at Example C. Where is the multiplier 8 written?

First multiply 3 da. by 8.

Then multiply 1 wk. by 8.

How do you change 8 wk. 24 da. to 11 wk. 3 da.?

Multiply in the examples below.

Compare your answers with the correct answers at the end of this Self-Help. Correct any mistakes.

1.	8 T. 213 lb. × 3	6 min. 39 sec. × 8	7′ 3″ × 11
2.	22 qt. 1 pt. × 7	8 wk. 3 da. × 12	31 lb. 3 oz. × 4
3.	13 gal. 1 qt. × 6	39 min. 14 sec. × 5	17 pk. 2 qt. × 2
4.	14 yr. 3 mo. × 9	12 T. 1694 lb. × 9	15 qt. 1 pt. × 7
5.	7 wk. 5 da. × 3	91 mi. 435 ft. × 6	59 yr. 9 mo. × 3

Answers

1.	24 T. 639 lb.	53 min. 12 sec.	79′ 9″
2.	157 qt. 1 pt.	101 wk. 1 da.	124 lb. 12 oz.
3.	79 gal. 2 qt.	196 min. 10 sec.	34 pk. 4 qt.
4.	128 yr. 3 mo.	115 T. 1246 lb.	108 qt. 1 pt.
5.	23 wk. 1 da.	546 mi. 2610 ft.	179 yr. 3 mo.

Self-Help 42

Example D shows how to divide 40 bu. 2 pk. by 12. First change 40 bu. 2 pk. to pecks. How do you get 162 pk.?

D

40 bu. 2 pk. = 162 pk.

162 pk. ÷ 12 = $13\frac{1}{2}$ pk.

$13\frac{1}{2}$ pk. = 3 bu. $1\frac{1}{2}$ pk.

Then divide 162 pk. by 12. 162 pk. ÷ 12 = $13\frac{1}{2}$ pk. Change $13\frac{1}{2}$ pk. to bushels and pecks. Is 3 bu. $1\frac{1}{2}$ pk. the correct answer for Example D?

Divide in the examples below. When you have compared your answers with the correct ones, correct any mistakes you may have made.

1. 49 min. 35 sec. ÷ 7
2. 16 bu. 3 pk. ÷ 8
3. 39 yr. 4 mo. ÷ 12
4. 23 yd. 1 ft. ÷ 5
5. 20 qt. 1 pt. ÷ 2
6. 27 yr. 9 mo. ÷ 9
7. 39 lb. 6 oz. ÷ 12
8. 58 min. 4 sec ÷ 8
9. 81 mi. 655 ft. ÷ 5
10. 24 wk. 6 da. ÷ 3
11. 22 pk. 6 qt. ÷ 7
12. 13 hr. 31 min. ÷ 6
13. 731 mi. 355 ft. ÷ 10
14. 37 bu. 2 pk. ÷ 15

Answers

1. 7 min. 5 sec.
2. 2 bu. $\frac{3}{8}$ pk.
3. 3 yr. $3\frac{1}{3}$ mo.
4. 4 yd. 2 ft.
5. 10 qt. $\frac{1}{2}$ pt.
6. 3 yr. 1 mo.
7. 3 lb. $4\frac{1}{2}$ oz.
8. 7 min. $15\frac{1}{2}$ sec.
9. 16 mi. 1187 ft.
10. 8 wk. 2 da.
11. 3 pk. 2 qt.
12. 2 hr. $15\frac{1}{6}$ min.
13. 73 mi. $563\frac{1}{2}$ ft.
14. 2 bu. 2 pk.

Additional Mathematical Terms*

61 ← *addend*
45 ← *addend*
15 ← *addend*
121 ← *sum*

173 ← *minuend*
65 ← *subtrahend*
108 ← *difference*

369 ← *multiplicand*
7 ← *multiplier*
2583 ← *product*

2 ← *quotient*
divisor → 52) 107 ← *dividend*
104
3 ← *remainder*

Terms that are sometimes used in addition, subtraction, multiplication, and division are shown above.

The *multiplicand* and the *multiplier* are sometimes called the *factors* of the *product.* The *factors* of a number are the numbers which when multiplied give that number. 3 and 4 are one pair of *factors* of 12.

The *lowest common denominator*, often written *L.C.D.*, is the smallest denominator that can be used in working an example in addition or subtraction of fractions.

The *numerator* and the *denominator* are called the *terms* of a fraction.

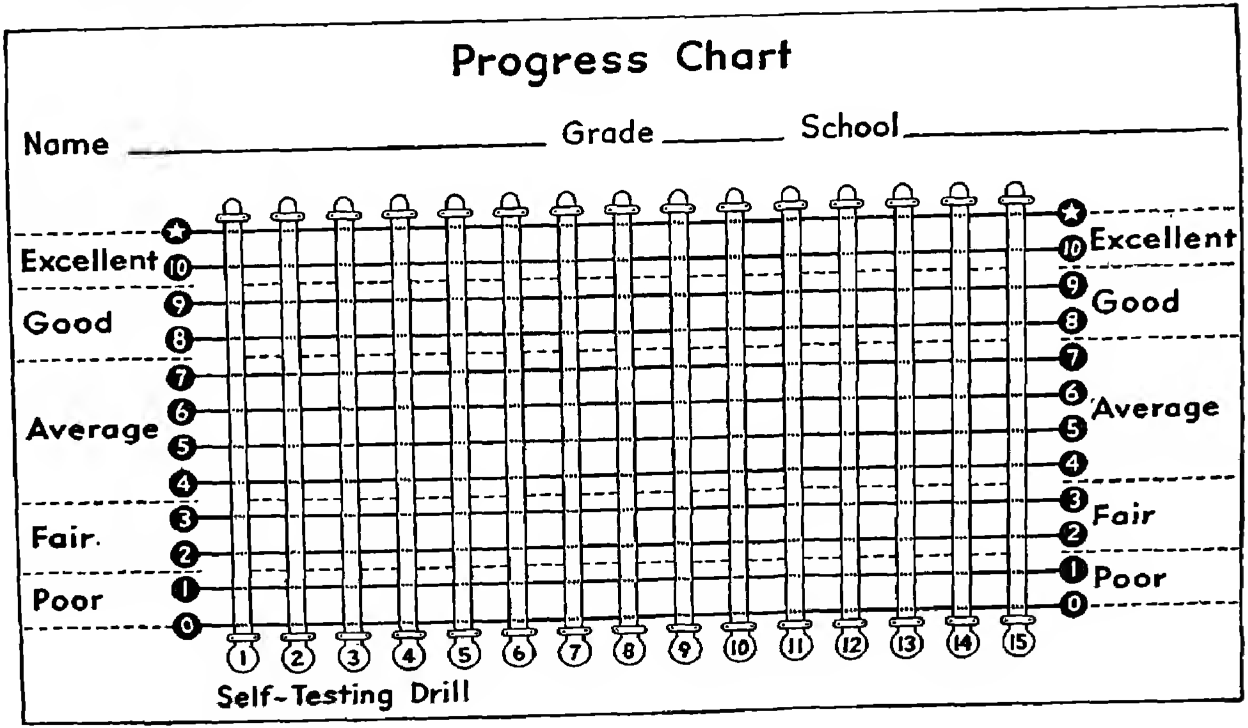
Reduced to lowest terms means *changed to simplest form.*

When a fraction is *reduced to higher terms*, it is changed to an *equal* fraction with a larger numerator and a larger denominator. For example, $\frac{3}{8}=\frac{6}{16}$.

Measures such as 3 qt., 16 mi., and 4 lb. are called *denominate numbers.* Measures such as 2 hr. 15 min. and 5 ft. 6 in. are called *compound denominate numbers.*

*TO THE TEACHER: The terms above are included for those schools whose courses of study require the mastery of such terms.

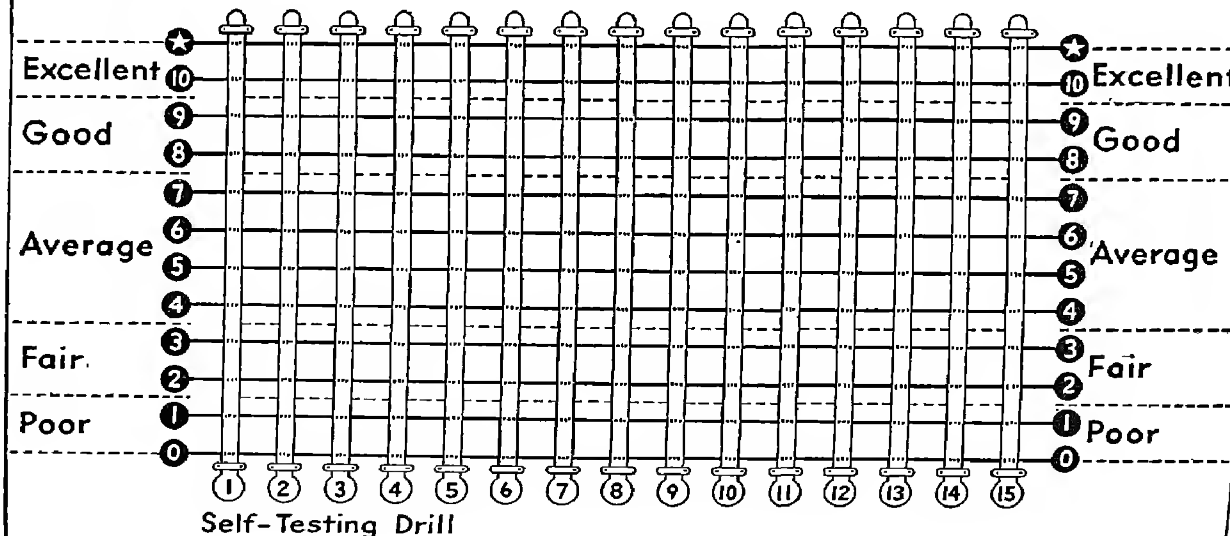
Read pages 76 and 77 if you do not know how to use this Progress Chart.



Read pages 76 and 77 if you do not know how to use this Progress Chart.

Progress Chart

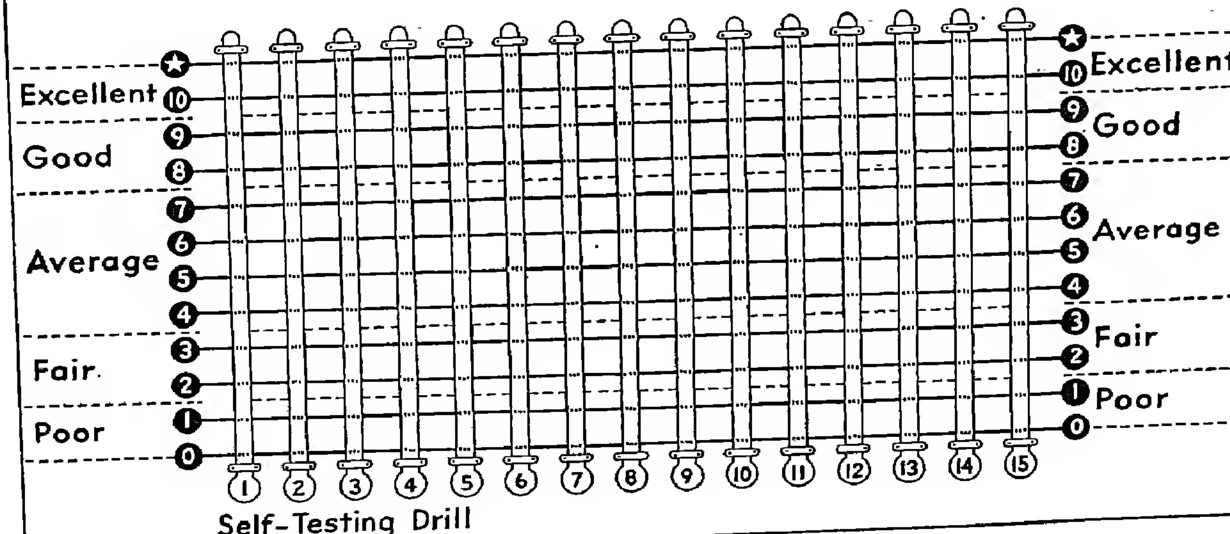
Name ______________________ Grade ________ School ____________________



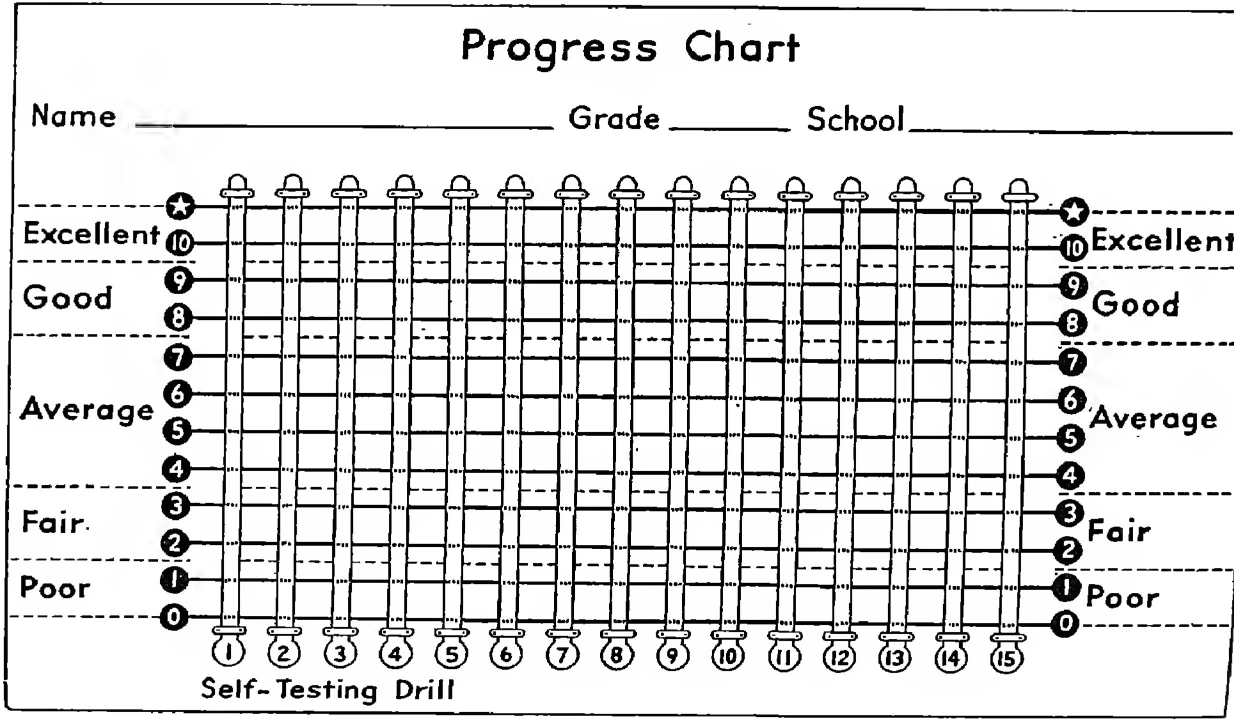
Read pages 76 and 77 if you do not know how to use this Progress Chart.

Progress Chart

Name ______________________ Grade ________ School ______________________



Read pages 76 and 77 if you do not know how to use this Progress Chart.



INDEX OF MATHEMATICAL CONTENT

All special maintenance features consist of mixed practice on various topics and processes. For distribution of practice on any given topic or process examine all pages listed.

Self-Help Tables of Measures

Measures of Length

★1 ft. = 12 in.
★1 yd. = 3 ft. = 36 in.
1 rd. = $5\frac{1}{2}$ yd. = $16\frac{1}{2}$ ft.
★1 mi. = 320 rd. = 1760 yd. = 5280 ft.
★1 meter = 39.37 in.
1 kilometer = $\frac{5}{8}$ mi. = 3281 ft.
1 centimeter = .4 in.
1 millimeter = .04 in.
1 hand = 4 in.
1 fathom = 6 ft.
1 nautical mile = 6080 ft.

Measures of Weight

★1 lb. (avoirdupois) = 16 oz. (avoirdupois)
1 lb. (troy) = 12 oz. (troy)
1 lb. (apothecaries) = 12 oz. (apothecaries)
★1 T. = 2000 lb.
1 long ton = 2240 lb.
1 gram = .035 oz. = $\frac{1}{30}$ oz.
1 kilogram = 2.2 lb.
1 carat = $\frac{1}{5}$ gram

Liquid Measures

★1 pt. = 2 cupfuls
★1 qt. = 2 pt.
★1 gal. = 4 qt.
1 liter = 1.06 qt.

Dry Measures

★1 qt. = 2 pt.
★1 pk. = 8 qt.
★1 bu. = 4 pk.

Measures of Time

★1 min. = 60 sec.
★1 hr. = 60 min.
★1 da. = 24 hr.
★1 wk. = 7 da.
★1 yr. = 12 mo. = 52 wk. = 365 da.
★1 leap year = 366 da.

Measures of Counting

★1 pair = 2 things
★1 doz. = 12 things

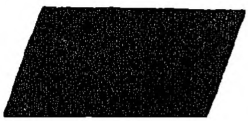
Square Measures

★1 sq. ft. = 144 sq. in.
★1 sq. yd. = 9 sq. ft.
★1 A. = 160 sq. rd. = 4840 sq. yd.
★1 sq. mi. = 640 A.

Cubic Measures

1 cu. ft. = 1728 cu. in.
1 cu. yd. = 27 cu. ft.
1 cord = 128 cu. ft.
1 bu. = $1\frac{1}{4}$ cu. ft.
1 gal. = 231 cu. in.

Description



Pages 309-311

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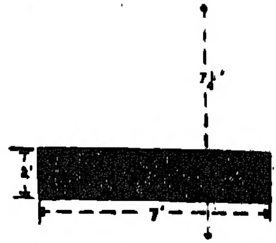

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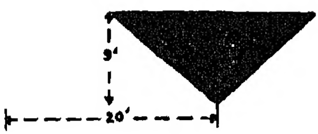

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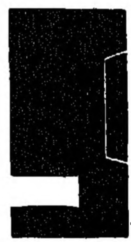
Description



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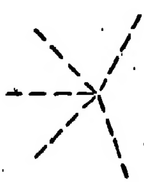

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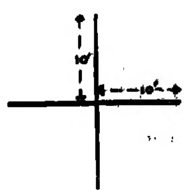

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